DELAWARE RIVER BASIN

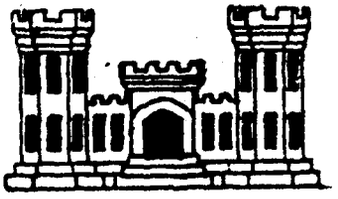
SWINGING BRIDGE DAM

SULLIVAN COUNTY, NEW YORK

INVENTORY NO. N.Y. 696

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

(6) Swinging Bridge Dam (Inventory Number NY-696),
Delaware River Basin, Sullivan County,
New York. Phase I Inspection Report.



CONTRACT NO. DACW-51-79-C-0001

(10) George Koch

(11) 24 Sep 79

NEW YORK DISTRICT CORPS OF ENGINEERS

JUNE 1979

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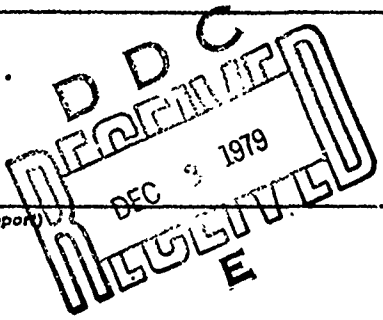

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and visual inspection of Swinging Bridge Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of deficiencies which if not remedied, may have the potential for developing into hazardous conditions. These deficiencies are as follows:

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1. Seepage at the toe and along the east abutment of the dam was evident. A depression was observed in the downstream slope above the original penstock near the center of the dam. Investigation of these conditions must be completed within 6 months of notification, and monitoring devices to measure flow and movement must be installed immediately with recording of information at weekly intervals until completion of the investigation.

2. Structural cracking of the gate tower (reportedly due to ice loading) and deterioration of the spillway slabs and flood gate supports was noted. Investigation of these conditions must be completed within 1 year of notification and repairs completed within the next construction season.

3. Removal of tree and vegetative growth observed in the spillway channel, on the spillway channel slopes, on the embankment slopes, at the abutment contacts and along the toe of the dam is required, and must be completed within this construction season.

4. Repair the depressions noted on the crest of the embankment (western end) and on the upstream slope near the watch tower during this construction season.

5. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference and develop an operations manual.

The discharge capacity of the spillway and the adjacent bedrock channel at both ends of the spillway is adequate to pass the Probable Maximum Flood (PMF = 47,800 cfs), without overtopping of the embankment portion of the dam, which is located approximately 1,000 feet southeast of the spillway. The maximum reservoir level during the PMF will be nearly equal to the top of the embankment at elevation 1080. The actual spillway capacity is only 39% of the PMF. However, the adjacent non-erodable bedrock channel at the north and south ends of the spillway will provide the additional capacity necessary to discharge the outflow from the PMF.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SWINGING BRIDGE DAM I.D. No. NY-696
DEC #148D - 155
DELAWARE RIVER BASIN
SULLIVAN COUNTY, NEW YORK

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PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Swinging Bridge Dam (I.D. No. NY-696)
State Located:	New York
County Located:	Sullivan
Stream:	Mongaup River (tributary of Delaware River)
Dates of Inspection:	November 8, 1978 and April 20, 1979

ASSESSMENT

The examination of documents and visual inspection of Swinging Bridge Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of deficiencies which if not remedied, may have the potential for developing into hazardous conditions. These deficiencies are as follows:

1. Seepage at the toe and along the east abutment of the dam was evident. A depression was observed in the downstream slope above the original penstock near the center of the dam. Investigation of these conditions must be completed within 6 months of notification, and monitoring devices to measure flow and movement must be installed immediately with recording of information at weekly intervals until completion of the investigation.

2. Structural cracking of the gate tower (reportedly due to ice loading) and deterioration of the spillway slabs and flood gate supports was noted. Investigation of these conditions must be completed within 1 year of notification and repairs completed within the next construction season.

3. Removal of tree and vegetative growth observed in the spillway channel, on the spillway channel slopes, on the embankment slopes, at the abutment contacts and along the toe of the dam is required, and must be completed within this construction season.

4. Repair the depressions noted on the crest of the embankment (western end) and on the upstream slope near the watch tower during this construction season.

5. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference and develop an operations manual.

The discharge capacity of the spillway and the adjacent bedrock channel at both ends of the spillway is adequate to pass the Probable Maximum Flood (PMF = 47,800 cfs), without overtopping of the embankment portion of the dam, which is located approximately 1,000 feet southeast of the spillway. The maximum reservoir level during the PMF will be nearly equal to the top of the embankment at elevation 1080. The actual spillway capacity is only 39% of the PMF. However, the adjacent non-erodable bedrock channel at the north and south ends of the spillway will provide the additional capacity necessary to discharge the outflow from the PMF.

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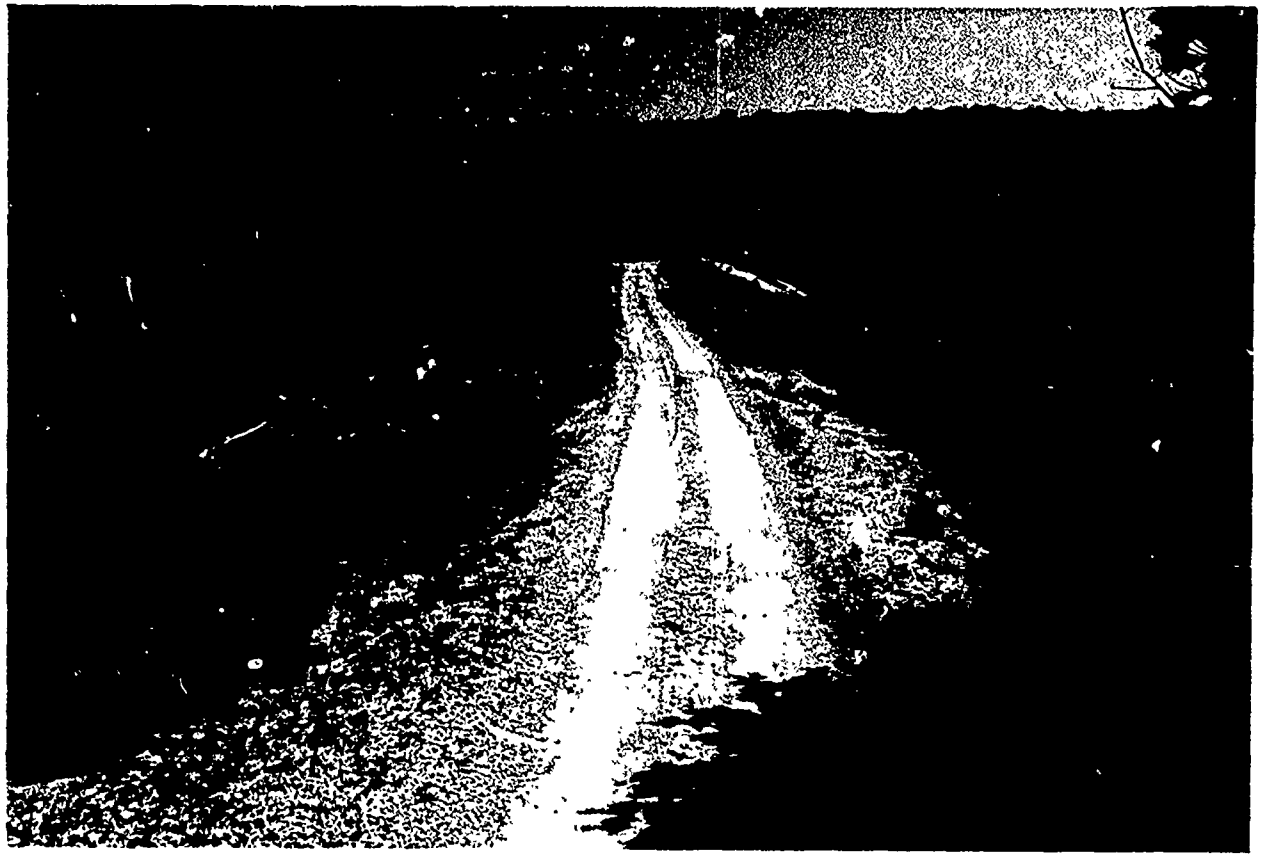
Approved By:

Col. Clark H. Benn
New York District Engineer

Date: 24 Sept 79



Overview of Swinging Bridge Dam

Photo #1

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SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase 1 inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenant Structures

The Swinging Bridge Dam is a 975 feet long hydraulically placed earth dam with a spillway located approximately 1000 feet northwest of the dam. The maximum height of the dam is 135 feet. The upstream slope is 1 vertical on 3.5 horizontal, the downstream slope is 1:2.5 and the crest width is 25 feet. The dam is composed of a clay and fine sand core extending from the center of the crest with slopes of 1:1 to the original grade, a core trench with maximum dimensions of 50 feet wide, 10 feet deep (side slopes = 1:1), an outer zone of boulders, gravel and sand, and rockfill toes, the material of which was obtained from spillway excavation. All exposed surfaces of the embankment were riprapped.

An intake located at the toe of the upstream slope and a gate tower located in the upstream face of the dam control the flow through the 10 feet diameter penstock to the number 1 generator. Two 24 inch diameter pipes serve as reservoir drains and are located in the conduit below the penstock. A second penstock and intake was installed at a later date near the west abutment of the dam to provide flow to generator number 2. This penstock is 10 feet in diameter. Both generators are located at the toe of the dam. The spillway is founded on sandstone. Five electrically operated flood gates each 22.6 feet wide and 6 feet high control the flow thru the spillway. Flashboards located on the north end of the flood gates are 122 feet long and 6 feet high.

b. Location

Swinging Bridge Dam is located on the Mongaup River, a tributary of the Delaware River, about 2 miles northwest of the Village of Forestbury and 7 miles southwest of the City of Monticello.

c. Size Classification
The dam is 135 feet high and stores 36,800 acre-feet of water. It is classified as a "large" dam (in excess of 100 feet).

d. Hazard Classification
The dam is classified as high hazard because of its location, about 11 miles north of the Village of Mongaup and upstream of 2 other large dams.

e. Ownership
The dam is owned and operated by Orange and Rockland Utilities Inc., 1 Blue Hill Plaza, Pearl River, NY, 10965, Tel: (914) 627-2410 or (914) 343-0621.

f. Purpose of the Dam
The dam provides storage for power development. Recreation is permitted except at the southern end of the reservoir where the dam and spillway are located.

g. Design and Construction History
The dam was designed in 1925 by Charles H. Tenny & Co., Engineers, 200 Devonshire Rd., Boston, Mass. for the Catskill Power Corporation, Middletown, NY. The dam was constructed in 1929 by Fred T. Ley Inc., Central Contractor, Boston, Mass. The second generating plant and penstock system was constructed in 1938.

h. Normal Operating Procedures
Water releases from the Swinging Bridge Reservoir are passed through either of the two penstock systems from intakes to the generating stations located at the toe of the dam. Generation discharges are intended to maximize power development and minimize spillage through the spillway section. The generating capacity of the Swinging Bridge Reservoir is supplemented from Toronto and Cliff Lake Reservoirs by use of conduits. (See Section 4 - Operation and Maintenance Procedure).

1.3 PERTINENT DATA

a.	Drainage Area (sq. mi)	118
	Height of dam (feet)	135
b.	Discharge at Dam Site (cfs)	
	Maximum known Flood	9,143 in August 1955
	Spillway at Design Pool (El. 1073*)	23,600
	Spillway at Maximum Pool (El. 1080*)	-
	Maximum Capacity of Reservoir drains	2-24" 80 C.F.S.
	Total Discharge, Max. Pool	-
	Average Daily Discharge	Varies
	Maximum Capacity of Penstock	2 X 585 = 1170
c.	Elevation (ft. above MSL-Datum)	
	Top of Dam	1080
	Design Pool	1073
	Spillway Crest	1065
	Tailrace Channel	938.5
	Tailwater Elevation	945.5
	Invert Reservoir Drain Inlet	951
	Unit #1 Invert Penstock Inlet	964.5
	Unit #2 Invert Penstock Inlet	1015

d. Reservoir

Length of maximum Pool, Miles		7
Length of Shoreline (Spillway Crest) miles		15.23
Surface area (Top of Flashboards (1070)) acres		1000

e. Storage, (Acre-feet)

Spillway Crest		27,350
Maximum Design Pool		34,700
Top of Dam		-

f. Dam

Type:	Hydraulic Fill	(Earth fill)
Length (ft.)		975
Upstream slope		3.5:1
Downstream slope		2.5:1
Impervious Core	Clay and Fine Sand.	
Crest elevation, ft.		1080
Crest Width, ft.		25
Grout Curtain		None

g. Spillway

Type:	Comb. Flashborads & Gates	(125' each)
Length, ft.		250'
Crest Elevation MSL		1065
Upstream Channel		Natural Rock
Downstream Channel		Natural Rock & Concrete

a. Regulating Outlet — Unit #2 - 10' diameter penstock, shape inverted "U";
Unit #1 - 10' diameter penstock.

i. Reservoir drain — 2-24" pipe.

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Geology

The Swinging Bridge Dam is located in the "Appalachian Uplands" physiographic province of New York State. This province (northern extreme of the Appalachian Plateau) was formed by dissection of the uplifted but flat lying sandstones and shales of the middle and upper Devonian Catskill Delta. Relief is high to moderate. Maximum dissection occurs in the Catskill Mountain area, where only the mountain peaks approximate the original plateau surface. Drainage is generally south or southwest toward the Delaware River system.

b. Subsurface Investigation

A subsurface investigation was conducted and this information has been included in Appendix F - Drawings #KK 3-16 and KK 3-18. In general, the borings indicate that the soils at this site are of glacial till origin (sand, clay and stone of varying mixtures), over shale and sandstone bedrock.

The "General Soil Map of New York State" prepared by Cornell University Agriculture Experiment Station indicates that the surficial soils are of the Lackawanna series. This soil series has poor internal drainage characteristics. Boulders are common and depth to bedrock is variable. Sandstone bedrock was observed outcropping in the excavated spillway channel.

c. Dam and Appurtenant Structures

The dam was designed by Charles H. Tenny, 200 Devonshire Rd. Boston, Mass. All drawings available have been included in Appendix F. The design of the dam includes a hydraulically placed core of clay and sand with adjacent zones of boulders, gravel and sand, and slopes protected by riprap. Rockfill toes using spillway excavation material was incorporated in the design. The dam has a core trench which extends to "impervious material", with maximum dimensions of 50 feet wide and 10 feet deep. The spillway is located approximately 1000 feet northwest of the dam and is founded on sandstone bedrock.

2.2 CONSTRUCTION RECORDS

No information regarding the construction of the dam was available other than the year of completion and the contractor, that being 1929 and Fred T. Ley Inc. A second generating system was completed in 1938.

2.3 OPERATION RECORD

All information concerning operation and maintenance of the dam is on file at the power house.

2.4 EVALUATION OF DATA

Some of the data presented in this report has been made available by representatives of Orange and Rockland Utilities Inc. This information has been invaluable in the preparation of this report. All information gathered appears to be adequate and reliable for Phase 1 Inspection purposes.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of Swinging Bridge Dam and the surrounding watershed was conducted on November 8, 1978 and April 20, 1979. The weather was clear and the temperature ranged in the fifties. The reservoir level at the time of inspection was 1064.5, 15.5 feet below the top of the dam.

b. Embankment

The earth embankment shows no signs of major distress. However, the following conditions were observed: A minor depression was evident on the crest near the west end of the embankment. No signs of active movement were observed and the alignment of the crest appeared good. A depression was observed on the downstream slope approximately one-third the slope length from the toe and above the penstock. This depression is approximately 10 feet in diameter with a maximum depth of 2 feet. No evidence of current movement was apparent. A third depression was observed on the upstream slope near the watch tower structure. This depression is approximately 10 feet by 15 feet with a maximum depth of 1 foot. No evidence of on-going movement was discovered. The cause of this depression is most likely wave action from the reservoir. Numerous small trees and vegetation were observed on the slopes, at the abutment contacts and along the toe of the dam. No erosion or seepage was discernible on the slopes or at the abutments of the dam. No evidence of subsidence, depressions, or movement was present in the downstream area below the dam. Numerous areas of seepage emerged in this area and are described in the following sub-section. As a consequence of this seepage, the surfacial soils in the vicinity were soft, particularly on the west side of generation station #1.

c. Seepage

Five zones of seepage were observed at and below the toe of the dam and along the original grade near the east abutment. Section 3-e of the "Visual Inspection Checklist" - Appendix C contains a sketch of these areas; the following numbers correspond to the numbers shown in the Appendix.

1) A catch basin north of generation station #1 between the access road and the toe of the dam was observed. Examination of this basin revealed flow at a rate of approximately 10 gallons per minute (gpm) entering the basin from a drain which extends eastward along the toe of the dam and partially up the east abutment. Flow from the catch basin is directed under the access road toward the generation building. No evidence of particle migration or sedimentation within the catch basin was observed.

2) Near the southwest corner of generation building #1, a 6 inch diameter pipe was placed to collect seepage water. This pipe was not taking the full flow and water was by-passing the pipe along the west side. This area was very wet and the soil very soft. Flow was estimated to be 10 gpm through the pipe and 10 gpm by-passing the pipe. The source of the seepage is unknown and no transportation of fine soil material was noted (Photo #10).

3) Approximately equidistant from the generation buildings and below the access road, a 4 inch diameter pipe was exiting from the slope. A metal container, presumable used to collect or measure flow, was placed beneath the outlet of this pipe. No flow was observed and its previous performance is uncertain.(Photo #9).

4) Seepage was noted exiting from and in the vicinity of two 15 inch diameter pipes located in a swale area (original grade) southeast of the toe of the dam below an abandoned camp. Flow is estimated to 10 gpm with no migration of soil particles. The two pipes appear to have provided control of run-off along the east abutment, but are now plugged with soil and vegetation (Photo #12 and 12).

5) A wet area was encountered near and beneath the northeast corner of the abandoned camp. No flow was observed exiting this level area (Photo #13).

Maintenance personnel reported observing the seepage as described above for their duration of employment at the site.

d. Spillway

Considerable concrete spalling and deterioration was observed on the flood gate supports and the spillway slabs. In certain areas, the spalling has progressed to the point where reinforcing bars are exposed. This spalling appears to be related to exposed surfaces where ice and water have initiated deterioration. Leaking of flashboards was also noted. Considerable tree growth was observed in the tailrace channel and along the channel slopes. The flood gate system was reported to be operational.

e. Regulating Outlets

All reservoir drains, power generation systems, and associated valves were reported operational. The gate tower located in the upstream face of the dam was examined, and structural cracking of the concrete was discovered 84.8 feet below the tower floor at Elevation 995.2. This cracking was reported to be a result of ice pressure from the reservoir. Steel straps, secured to the concrete on either side of the cracked areas, were installed to insure the integrity of the structure. Calcification was also apparent on the walls of the tower at various locations.

f. Downstream Channel

The downstream channel appears to be in good condition. Since the spillway and outlet channel foundations are sandstone bedrock, the condition of the downstream channel will probable not influence the performance of the spillway and appurtenances.

g. Reservoir

There are no visible signs of instability or sedementation problems in the reservoir area.

3.2 EVALUATION OF OBSERVATIONS

Significant conditions were observed which require immediate investigation to determine the type of corrective action necessary to insure the stability of the dam and appurtenances. The following is a summary of the problem areas encountered, in order of importance.

1. The seepage observed at various locations at or near the toe of the embankment and along the east abutment.

2. The depression observed on the downstream slope above the penstock (10 feet in diameter, 2 feet deep maximum).

3. The cracking noted in the gate tower.

4. The deterioration of concrete located on the spillway slabs and flood gate supports.

5. Tree and other vegetative growth noted in the spillway channel, at the abutments and along the toe of the embankment.

These conditions do not represent any imminent danger, however, remedial action must be undertaken to prevent the development of hazardous conditions.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURE

4.1 PROCEDURE

The Swinging Bridge Dam is a power generating dam for Orange and Rockland Utilities Inc. Two penstocks carry water from the reservoir to the two power plants located at the toe of the dam. Flow through the 10 feet diameter penstock to generating station #1 is controlled by an 8 feet diameter remote controlled electrically operated butterfly valve, located in the gate tower. Below this valve, two 24 inch diameter gate valves serve as reservoir drains. Flow through the 10 feet diameter penstock to generating station #2 is controlled by a remote controlled electrically operated butterfly valve located in the gate house at the northwest corner of the embankment. This penstock is connected to a surge tank. In addition, flow at the entrance to each generator can be controlled by wicket gates.

Five flood gates located on the south end of the spillway control the discharge not utilized for power generation. These gates are operated by electric motors placed on the bridge above the gates.

Two water supply conduits, one from Cliff Lake Reservoir and one from Toronto Reservoir, augment the storage capacity of Swinging Bridge Reservoir, so that during low flow conditions, power can still be generated.

All valves are remote controlled by the systems operator located on Dolson Avenue, Middletown, NY.

4.2 MAINTENANCE OF DAM

The operation and maintenance manual and records for the facility are on file in the generating building. Maintenance of the dam appears to be adequate with the exceptions noted in "Section 3: Visual Inspection". Maintenance of the spillway is inadequate in as much as deterioration of concrete surfaces is well advanced.

4.3 MAINTENANCE OF OPERATING FACILITIES

Maintenance of generating equipment and associated valves, conduits, etc.. appear to be excellent.

All valves are reported to be operational. No operations manual is on file. A record of maintenance operations is on file with the maintenance staff.

4.4 WARNING SYSTEM IN EFFECT

An excellent warning system has been developed by the owner, in accordance with the Fedeval Energy Regulating Commission standards. This system was recently updated (Dec. 7, 1978) and is included in Appendix F.

4.5 EVALUATION

Certain remedial measures are required to provide the proper maintenance. Deterioration of concrete surfaces in the spillway system, and cracking in the gate tower are areas which need further maintenance. Vegetative growth in the spillway channel and at the dam must be removed.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

The Swinging Bridge Dam is located on the Mongaup River, a tributary of the Delaware River. The drainage area at the dam site is 118 square miles. The topography is characterized by steep slopes interspersed by swamps, ponds and lakes.

5.2 ANALYSIS CRITERIA

Information on the Standard Project Flood (SPF) for the Swinging Bridge Dam and its watershed was obtained from the "Upper Delaware River Basin Hydrologic Flood Routing Model" prepared in 1976 by Water Resources Engineers, Inc. for the New York District of the U.S. Army Corps of Engineers. The rainfall-runoff mathematical model HEC-1 developed by the U.S. Army Corps of Engineers was used to reconstruct major floods and to simulate the SPF considered in the study. SPF is approximately one-half of Probable Maximum Flood (PMF).

The Swinging Bridge Dam watershed is located within the subbasin 50 of the Delaware River Basin. The inflow was routed through the reservoir and the peak outflow was determined to be 23,900 cfs for the SPF.

5.3 SPILLWAY CAPACITY

The spillway is 122 feet long and is topped by 6 feet high flashboards. There are 5 electrically operated floodgates, each 22.6 feet wide, located south of the spillway. The capacity of the spillway and floodgates is 18,600 cfs with the flashboards removed and gates completely opened.

5.4 RESERVOIR CAPACITY

The reservoir capacities at the crest of spillway, and at the top of the flashboards are 27,400 acre-feet (AF) and 34,100 AF respectively. The storage capaicty curve is shown in Appendix D. The curve indicates a surcharge storage of 4,400 AF which is equivalent to a runoff depth of 0.70 inches over the drainage area.

5.5 FLOODS OF RECORD

Maximum flood recorded is 9100 cfs on August 1955.

5.6 OVERTOPPING POTENTIAL

The maximum combined capacity of the floodgates and spillway is 18,600 cfs compared to a SPF of 23,900 cfs. Hence, the floodgates and spillway can pass 78 percent of the SPF. Since the SPF is approximately one-half of PMF, the floodgates and the spillway are capable of passing only 39 percent of PMF (47,800 cfs). The adjacent non-erodable bedrock channel which extends to the north and south at the ends of the spillway will provide additional discharge capacity. This additional capacity will be such that the reservoir level will approximate the top of embankment (elevation 1080) during the PMF. Therefore, no overtopping of the dam will result.

5.7 EVALUATION

The spillway and adjacent bedrock channel is adequate to pass the PMF, and no overtopping of the earth embankment section, approximately 1000 feet southeast of the spillway, will result.

SECTION 6 STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

The following visual observations indicate distress within the earth embankment, although these observations do not indicate conditions which pose an immediate hazard to human life or property:

1. Seepage at the toe and along the east abutment.
2. Depression on the downstream slope above the penstock (10' diam, 2' deep).

The following visual observations indicate deterioration or distress in the concrete elements of the dam, but do not pose an immediate hazard to life or property:

1. Cracking of the gate tower due to reservoir ice loading.
2. Deterioration of concrete at the spillway slabs and flood gate supports.

b. Design and Construction Data

No design computations or construction information regarding the structural stability of the dam are available.

c. Operating Records

No operational problems were reported which would influence the stability of the structure.

d. Post-Construction Changes

A second generating system was installed in 1938 with the intake at the western edge of the embankment. Steel straps, used to repair the cracking of the gate tower, were installed in 1971.

e. Seismic Stability

Seismic forces in this zone are not considered to be of significant magnitude to influence the stability of the structure.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase 1 Inspection of Swinging Bridge Dam did not indicate conditions which constitute an immediate hazard to human life or property. The embankment is not considered to be unstable. However, seepage along the toe of the dam and at the east abutment, and the depression on the downstream face above the original penstock, require investigation and observation at periodic intervals to prevent the development of hazardous conditions. In addition, deterioration of the spillway concrete and structural cracking of the gate tower must be investigated and repairs instituted.

b. Adequacy of Information

The information reviewed is adequate for Phase 1 Inspection purposes.

c. Urgency

Investigation of the observed seepage and depression must be completed within 6 months of notification to the owner. In addition, weirs should be immediately constructed and measurements taken to monitor the flow of the seepage at all locations. Investigation of the structural cracking in the gate tower and deterioration of concrete on the spillway slabs and flood gate supports must be completed within 1 year of notification and repairs completed within the next construction season. Tree and other vegetative growth noted in the spillway channel, at the abutments and along the toe of the embankment must be removed during this construction season.

d. Need for Additional Investigations

To prevent the development of potentially hazardous conditions, investigations are required in the following areas:

1. Seepage at toe and along east abutment of the dam.

2. Depression observed on the downstream face of the dam above the penstock.

3. Structural cracking of the gate tower and deterioration of concrete on the spillway slabs and flood gate supports.

7.2 RECOMMENDED MEASURES

a. Results of the aforementioned investigations will determine the type and extent of remedial measures required for the observed seepage, depression, structural cracking and concrete deterioration.

The following improvements can be accomplished by maintenance forces:

b. Remove the tree and vegetative growth observed in the spillway channel and on the spillway slopes, on the embankment slopes, at the abutment contacts, and along the toe of the dam.

c. Repair the depressions noted on the crest of the embankment (western end) and on the upstream slope near the watch tower.

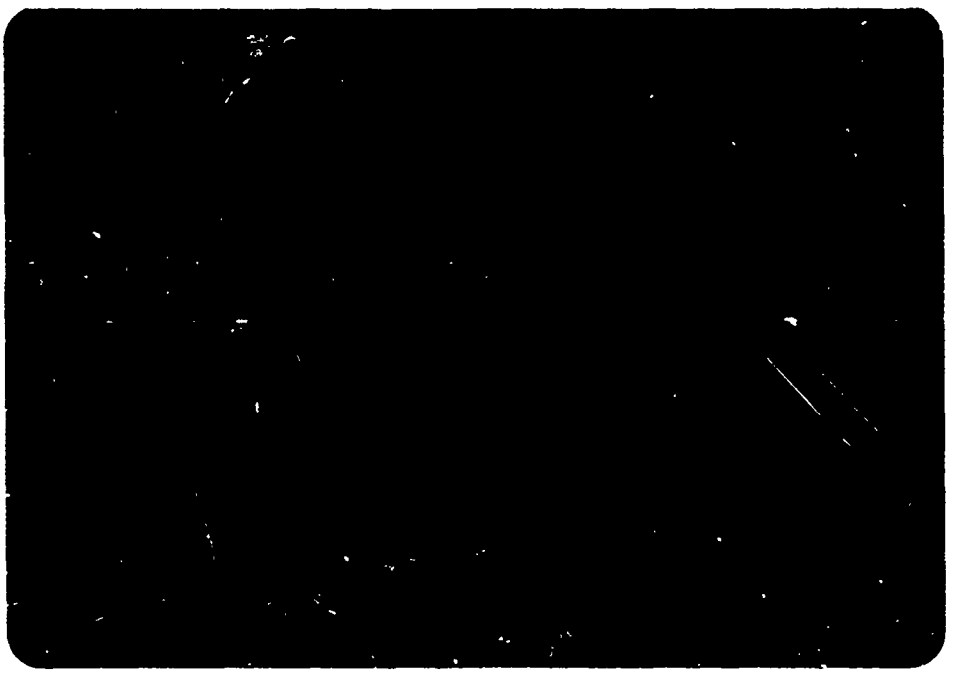
d. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference. Also develop an operations manual.

APPENDIX A

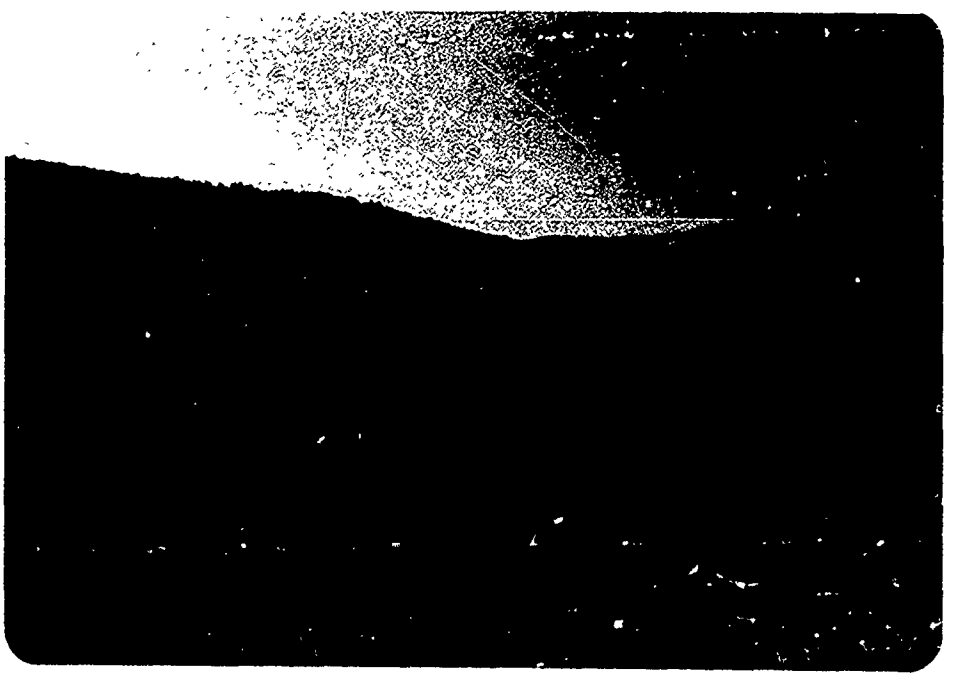
PHOTOGRAPHS

Upstream slope looking west
at Intake #2
Photo #2

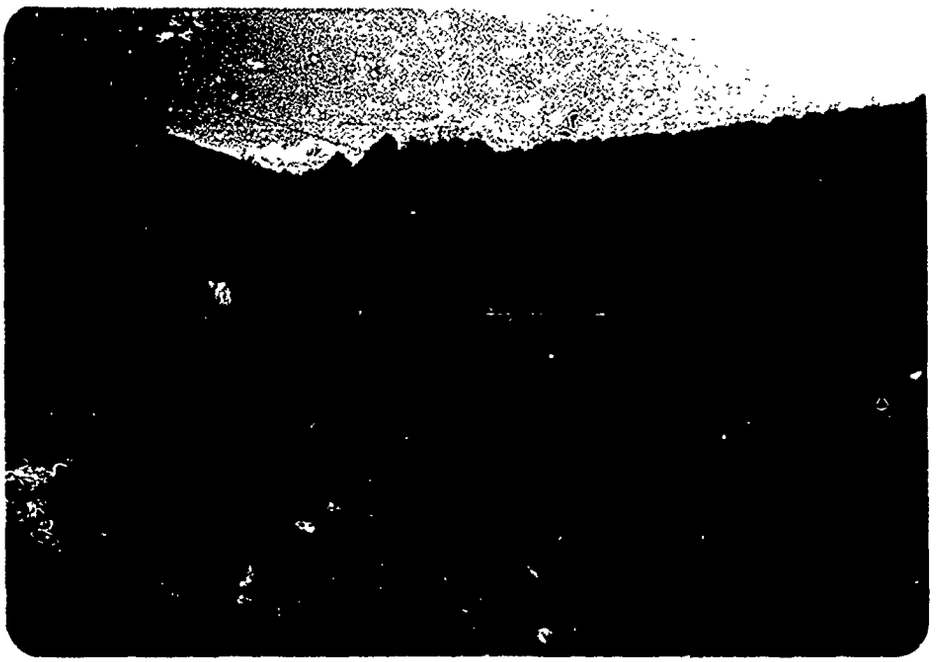
Upstream slope looking east
note depression in riprap
Photo #3



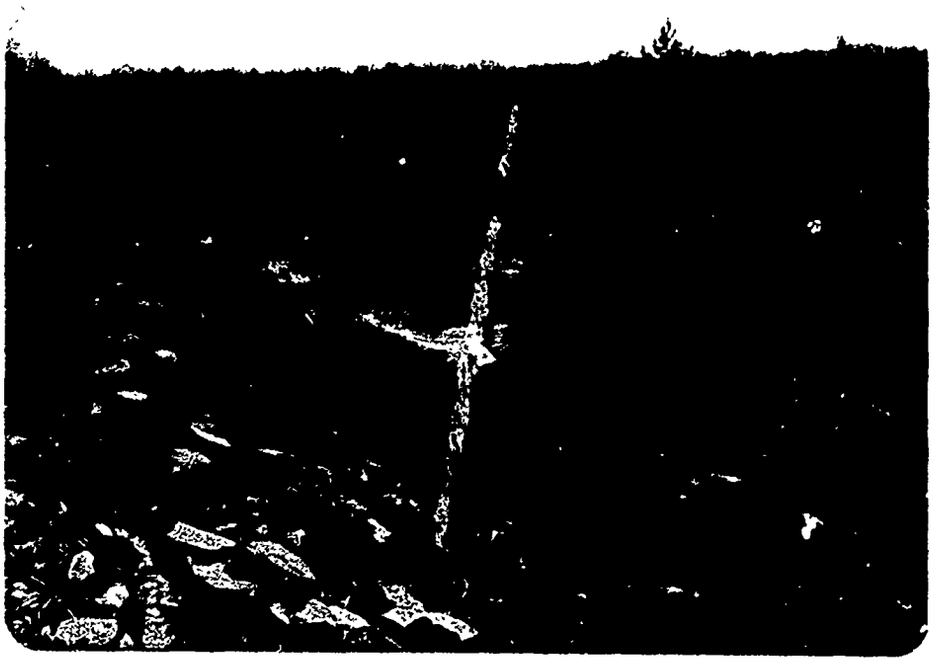
Gate Tower for Intake #1
Photo #4



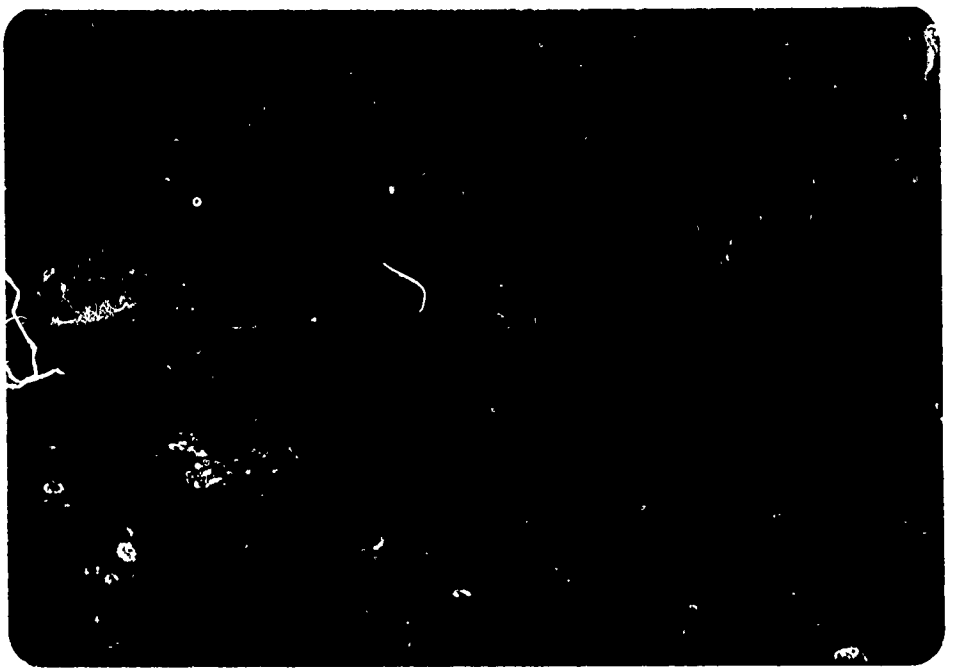
Downstream Channel
viewed from top of dam
Photo #5



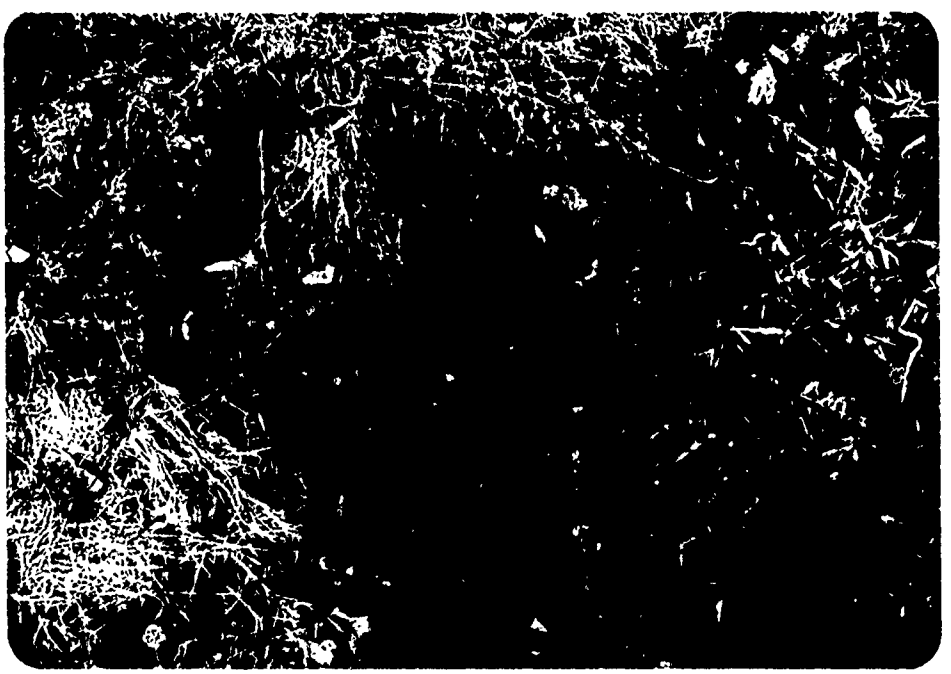
Downstream Slope
looking east
Photo #6



Downstream Toe & Generator #1
looking east
Photo #7

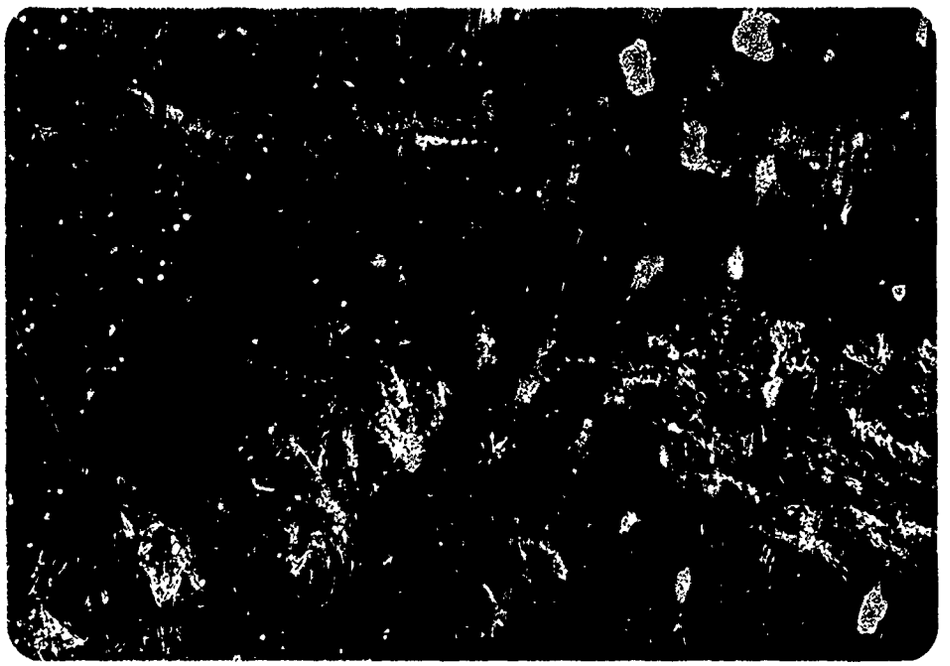


Depression in Downstream Slope
above penstock #1
Photo #8



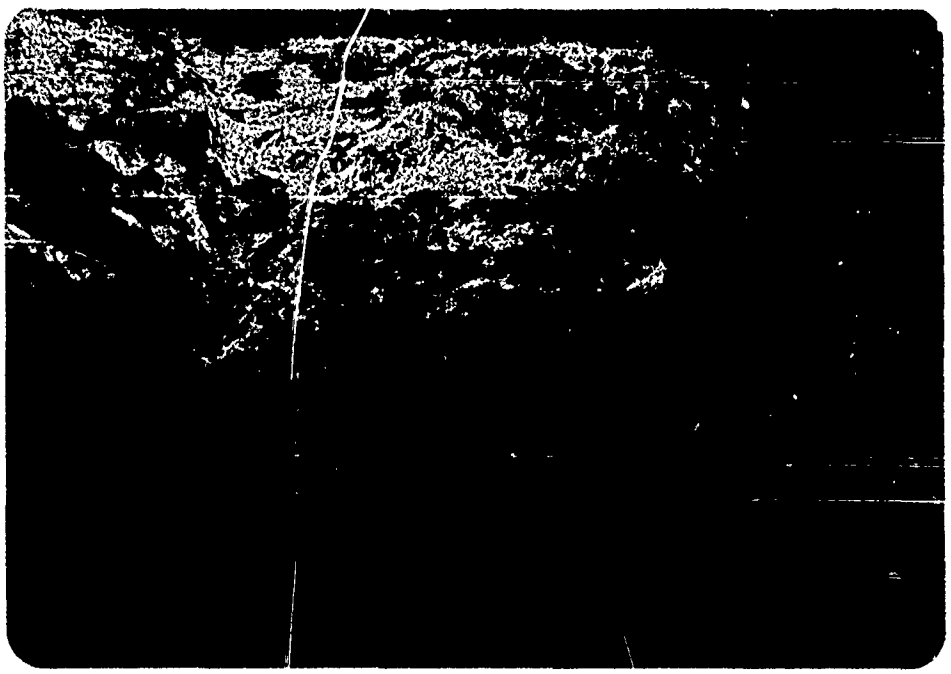
Seepage Collector (inactive)
Seepage point #3
Photo #9

Seepage near Southwest Corner of Generator #1
Seepage point #2
Photos #10 A&B



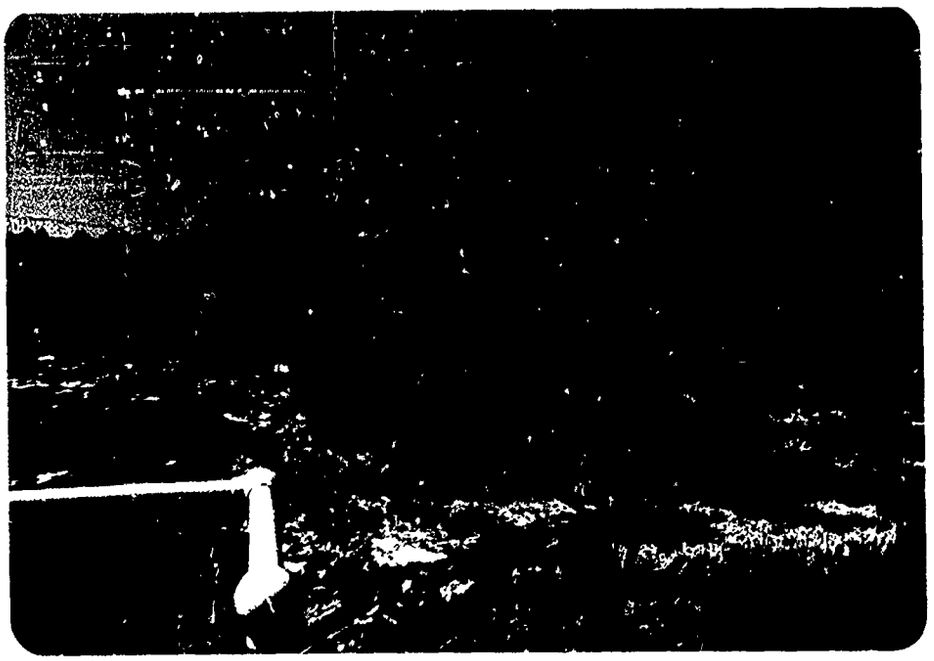
Seepage Point #4
East Abutment Area
Photo #11

Seepage Point #4
Note seepage at 15" pipe
Photo #12

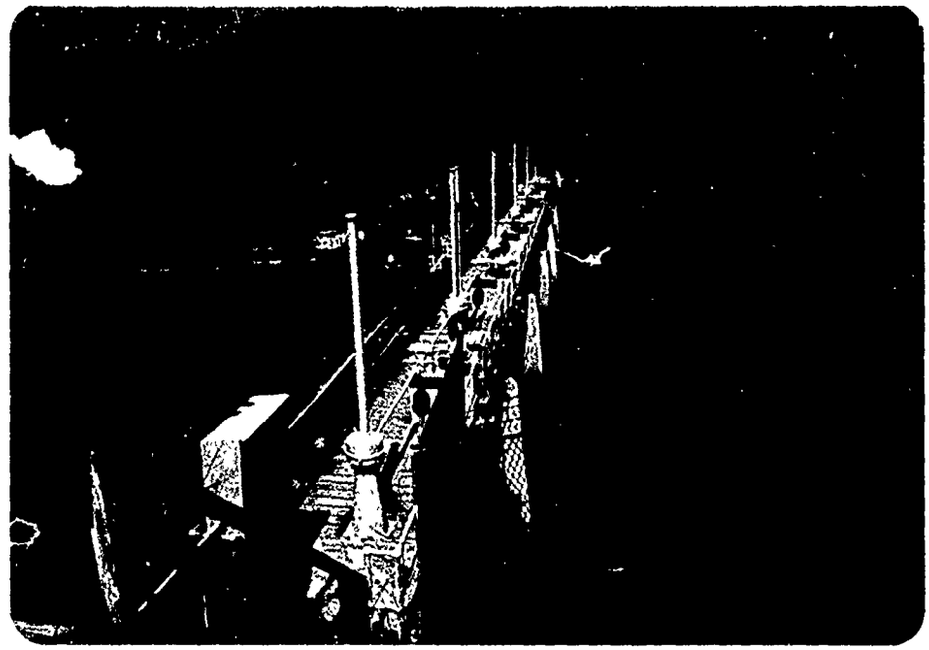


Seepage Point #5
Near abandoned camp
Photo #13

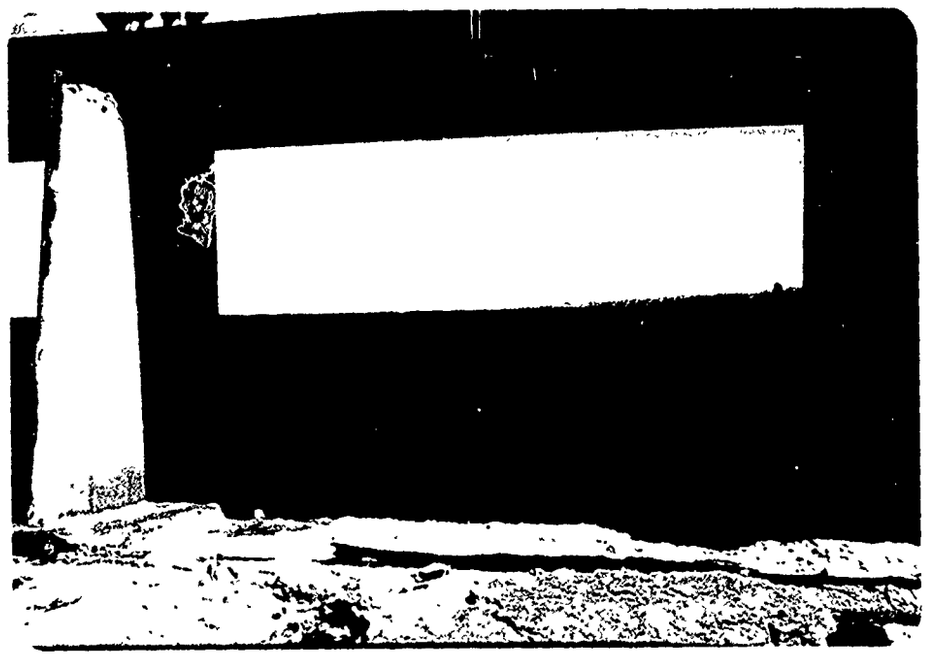
Spillway Viewed from Downstream Channel
Photo #14



Downstream Channel Viewed from Spillway
Photo #15

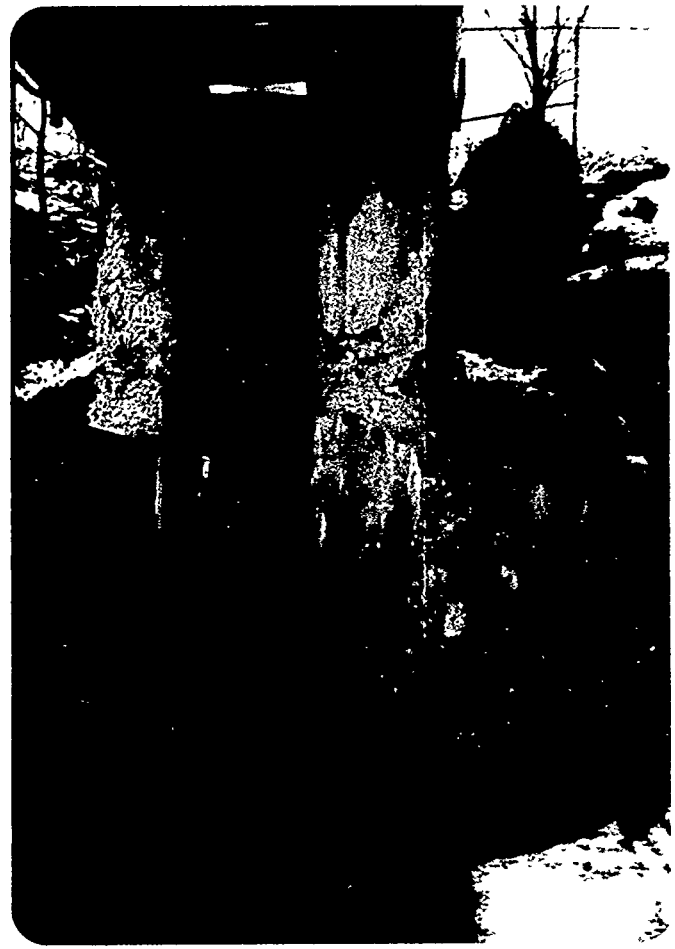


Spillway Flood Gate System
Looking north
Photo #16



Spillway Flood Gate
Note Deteriorated Concrete Slab
Photo #17

Spillway Flood Gate Supports
Note Deteriorated Concrete
Photo #18



Spillway - Deteriorated Concrete of
South Abutment
Photo #19

APPENDIX B

ENGINEERING DATA CHECKLIST

Check List
Engineering Data
Design Construction Operation

Name of Dam SWINGING [illegible]

I.D. # N.Y. 696

Item	Remarks		
	Plans	Details	Typical Sections
Dam	yes		yes
Spillway(s)	YES		yes
Outlet(s)	yes	yes	yes
Design Reports		NONE	
Design Computations		NONE	
Discharge Rating Curves			
Dam Stability		NONE	
Seepage Studies		NONE	
Subsurface and Materials Investigations		YES	

Item	Remarks
Construction History	YES
Surveys, Modifications, Post-Construction Engineering Studies and Reports	NONE
Accidents or Failure of Dam Description, Reports	NONE
Operation and Maintenance Records Operation Manual	YES OPERATION AND MAINTENANCE RECORDS ONLY. Emergency action plan (recently updated) 12/78

APPENDIX C

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam SWINGING BRIDGE

I.D. # NY 696

Location: Town FORESTBURG & LUMBERLAND County SULLIVAN

Stream Name MONGAUP RIVER

Tributary of DELAWARE RIVER

Longitude (W), Latitude (N) 74°47'00", 41°34'25"

Hazard Category C

Date(s) of Inspection NOV. 8, 1978, APRIL 20, 1979

Weather Conditions 50's. CLEAR SUNNY

b. Inspection Personnel ROBERT MCCARTY, MUHAMMAD ISLAM, KENNETH FIELD., Robert Stuber., Edward Kiene, Joseph Case

c. Persons Contacted KENNETH FIELD, Tel 914, 627-2410

Robert Stuber, Tel 914-786-3310

d. History:

Date Constructed APRIL 1929, 2nd generating plant constructed 1938

Owner ORANGE AND ROCKLAND UTILITIES, 1 BLUEHILL PLAZA PEARL RIVER, N.Y.

Designer CHARLES H. TENNEY 200 DEVONSHIRE RD, BOSTON., MASS.

Constructed by FRED T. LEY Inc. Central Contractor Boston Mass.

2) Technical Data

Type of Dam HYDRAULIC FILL

Drainage Area 117.6 SQUARE MILES

Height 135 FEET Length 975 FEET

Upstream Slope 3.5:1 Downstream Slope 2.5:1

2) Technical Data (Cont'd.)

External Drains: on Downstream Face NONE @ Downstream Toe ROCKFILL TOE

Internal Components:

Impervious Core CLAY AND FINE SAND

Drains NONE

Cutoff Type CUTOFF TRENCH FILLED WITH CLAY AND FINE SAND

Grout Curtain NONE

3) Embankment

a. Crest

(1) Vertical Alignment generally good - 1 minor depression near the west end of the embankment - not considered to be a problem

(2) Horizontal Alignment good

(3) Surface Cracks none

(4) Miscellaneous

b. Slopes

(1) Undesirable Growth or Debris, Animal Burrows numerous small trees on slopes - numerous large trees at abutment contacts and along toe

(2) Sloughing, Subsidence or Depressions Depression on downstream slope a ½ up from toe, approx. above penstock - dimensions ≈ 10' in diameter & ≈ 2 feet in max depth. no evidence of current movement. Observed a 1 foot depression approx 10'x15' near watch tower on upstream face - probably related to wave action

(3) Slope Protection Both upstream & downstream slopes riprapped.

(4) Surface Cracks or Movement at Toe none evident

(5) Seepage none evident

(6) Condition Around Outlet Structure good condition except seepage as noted in "3 d & e"

c. Abutments

good condition - some trees along abutment contacts

(1) Erosion at Embankment and Abutment Contact none

(2) Seepage along Contact of Embankment and Abutment none

(3) Seepage at toe or along downstream face See below

d. Downstream Area - below embankment

(1) Subsidence, Depressions, etc. none evident

(2) Seepage, unusual growth as described on next page

(3) Evidence of surface movement beyond embankment toe no evidence

(4) Miscellaneous Surface soil is soft on west side of generation station #1

e. Drainage System

1 drain at toe of embankment & north of access road - pipe extends to abutment areas estimated flow 10 gpm. 1 drain west of generator #1 below access road. described on next page. 1 drain below access road approx. ½ way between generator #1 & #2 no flow observed.

(1) Condition of relief wells, drains, etc. _____

generally good condition

(2) Discharge from Drainage System (Number system corresponds to areas on plan below)

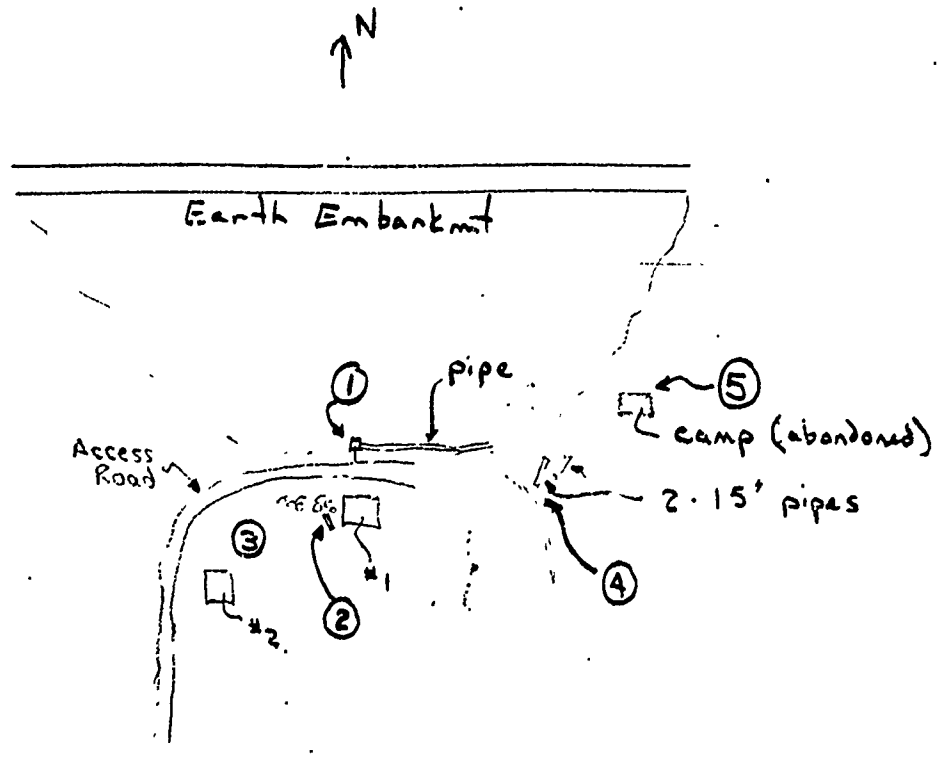
① About 10 gpm in front of generator #1 flowing from abutment areas to catch basin - no migration of fines

② About 10 gpm thru 6" pipe & 10 gpm by-passing pipe all from the same general area west of generator #1 - origin unknown, no fines

③ Drain between generators #1 & #2 no flow observed from 4" pipe

④ Seepage in swale on slopes of original grade near east abutment flow ≈ 10 gpm - this flow has been occurring as far back as they can remember at approx the same rate - no particle migration - The 2-15" pipes appear to have provided control for run-off but are now plugged w/ soil

⑤ A wet area was observed beneath the caretakers house no flow was observed.



4) Instrumentation

(1) Monumentation/Surveys NONE

reservoir water level gage on intake tower

(2) Observation Wells NONE

(3) Weirs NONE

(4) Piezometers NONE

NONE

(5) Other

5) Reservoir

a. Slopes OK

b. Sedimentation NONE REPORTED OR OBSERVED.

6) Spillway(s) (including tail race channel)

5 electrically operated flood gates each 22.6 feet wide & 6' high ;
flashboards 122 feet long & 6' high north of flood gates - spillway N.W. of dam

a. General The concrete spillway is founded on bedrock. The tailrace channel & downstream channel is bedrock formed or controlled. Concrete deterioration of flood gate supports - (some re-bars are exposed) and of spillway slabs

b. Principle Spillway

Flood discharge only

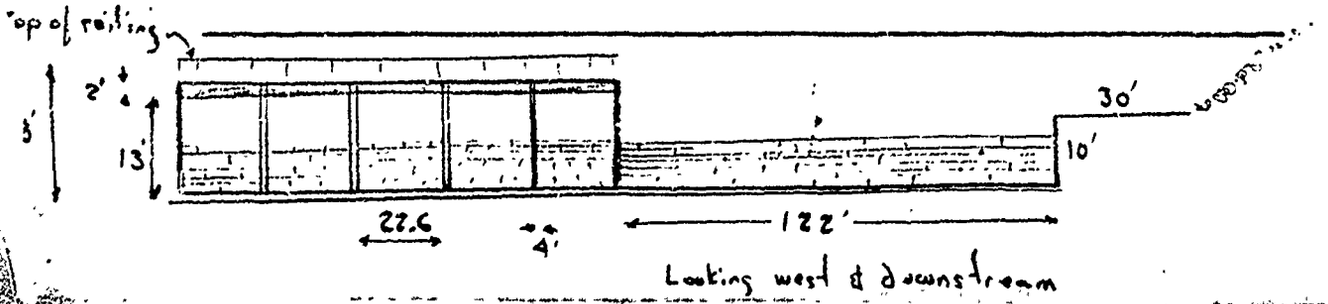
122' wide 6' high collapsible flashboards during a 1 foot overtopping (designed)
Some minor leakage of flashboards.

2 intakes for power generation described in section #8

c. Emergency or Auxiliary Spillway 5 Flood gates 22.6' wide & 6' high electrically operated from motor units above

d. Condition of Tail race channel Bedrock - some rock debris with a few trees directly below the spillway

e. Stability of Channel side/slopes Rock and riprapped channel no problems visible - however trees on banks should be trimmed out



7) Downstream Channel

natural channel

a. Condition (debris, etc.) generally in good condition used only during flooding; numerous trees

b. Slopes generally good

c. Approximate number of homes 8 homes - residents of Mongaup village

8) Miscellaneous Power generation system: 2 intakes, one for each generator generator #1 (1929) intake tower in reservoir Flow from intake tower to the penstock is controlled by an electrically operated butterfly valve. The control is in the tower. Flow from the reservoir to the 2nd generator is also controlled by a butterfly valve (electrically controlled) and the control is located at the gate house at the north-west corner of the embankment. this penstock is connected to a surge tank. In addition, water supply at entrance to each generator can be shut off by electrically operated valves located in each generator building. Each generator is started by a group of batteries.

9) Structural

a. Concrete Surfaces cracking and spalling of concrete surfaces in flood gate supports & spillway slabs concrete intake tower has some calcification

b. Structural Cracking cracking of intake tower due to ice loading metal straps have been used to stiffen this area

c. Movement - Horizontal & Vertical Alignment (Settlement) none observed

d. Junctions with Abutments or Embankments good condition

e. Drains - Foundation, Joint, Face see embankment section #3

f. Water passages, conduits, sluices where observed, good condition & operational

g. Seepage or Leakage none evident related to concrete deterioration

h. Joints - Construction, etc. good condition

i. Foundation spillway - rock foundation
intake systems - foundation unknown

j. Abutments no problems

k. Control Gates operational electric motors
for each u/s flood gates
intake systems electrically operated

l. Approach & Outlet Channels bedrock channels

m. Energy Dissipators (plunge pool, etc.) none

n. Intake Structures generally good condition

o. Stability appears good

p. Miscellaneous

APPENDIX D

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	1080		-
2) Design High Water (Max. Design Pool)	1073		38,500
3) Auxiliary Spillway Crest	-	-	-
4) Pool Level with Flashboards	1070	-	34,100
5) Service Spillway Crest	1065	1,100	27,400

DISCHARGES

	Volume (cfs)
1) Average Daily	Unknown
2) Spillway @ Maximum High Water	18,600
3) Spillway @ Design High Water	18,600
4) Spillway @ Auxiliary Spillway Crest Elevation	-
5) Low Level Outlet	-
6) Total (of all facilities) @ Maximum High Water	18,600
7) Maximum Known Flood	Unknown

CREST: ELEVATION: 1080

Type: HYDRAULIC FILL

Width: 25 FEET Length: 915 FEET

Spillover Location: In a cut section located at northwest of dam. length 122 feet. In addition 5 floodgates 22.6 ft wide (each). Nork-west of embankment and not connected to embankment.

SPILLWAY:

PRINCIPAL		EMERGENCY
1065	Elevation	NONE
channel in a cut section.	Type	
122 feet, 5 flood gates each 22.6'	Width	
	Type of Control	
—	Uncontrolled	
	Controlled:	
6 ft. high flashboards	Type (Flashboards; gate)	
—	Number	
—	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
—	Chute Length	
0	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate _____ Sluice _____ Conduit YES Penstock YES

Shape : INVERTED U SHAPED (UPPER CONDUIT)

Size: 10 FEET DIAMETER. ALSO 2 - 24" PIPE IN LOWER CONDUIT.

Elevations: Entrance Invert 959.50

Exit Invert 957.50

Tailrace Channel: Elevation 1065.0

HYDROMETEROLOGICAL GAGES:

Type : NONE

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: NONE. EMERGENCY ACTION PLAN UPDATED RECENTLY.

Method of Controlled Releases (mechanisms):

USUALLY THROUGH PENSTOCK. BUTTERFLY VALVE OF PENSTOCK IS OPERATED ELECTRICALLY. WATER CAN ALSO BE RELEASED THROUGH 2 - 24" VALVES IN LOWER CONDUIT.

DRAINAGE AREA: 117.6 SQUARE MILES

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: -

Terrain - Relief: -

Surface - Soil: -

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

NONE

Potential Sedimentation problem areas (natural or man-made; present or future)

NONE

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

NONE

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: NONE

Elevation:

Reservoir:

Length @ Maximum Pool 7 (Miles)

Length of Shoreline (@ Spillway Crest) 17.5 (Miles)

SWINGING BRIDGE DAM

Drainage area = 118 square miles.

From "Upper Delaware River Basin Hydrologic Flood Routing Model" study, subbasin 50 – pages T8 to F7 :

Area of subbasin 50 = 118 square miles.

The entire subbasin 50 is the drainage area of Swinging Bridge Dam.

Modified Standard Project Flood (MSPF) = $\frac{1}{2}$ Probable Max. Flood (PMF)

MSPF = 23,861 cfs ≈ 23,900 cfs

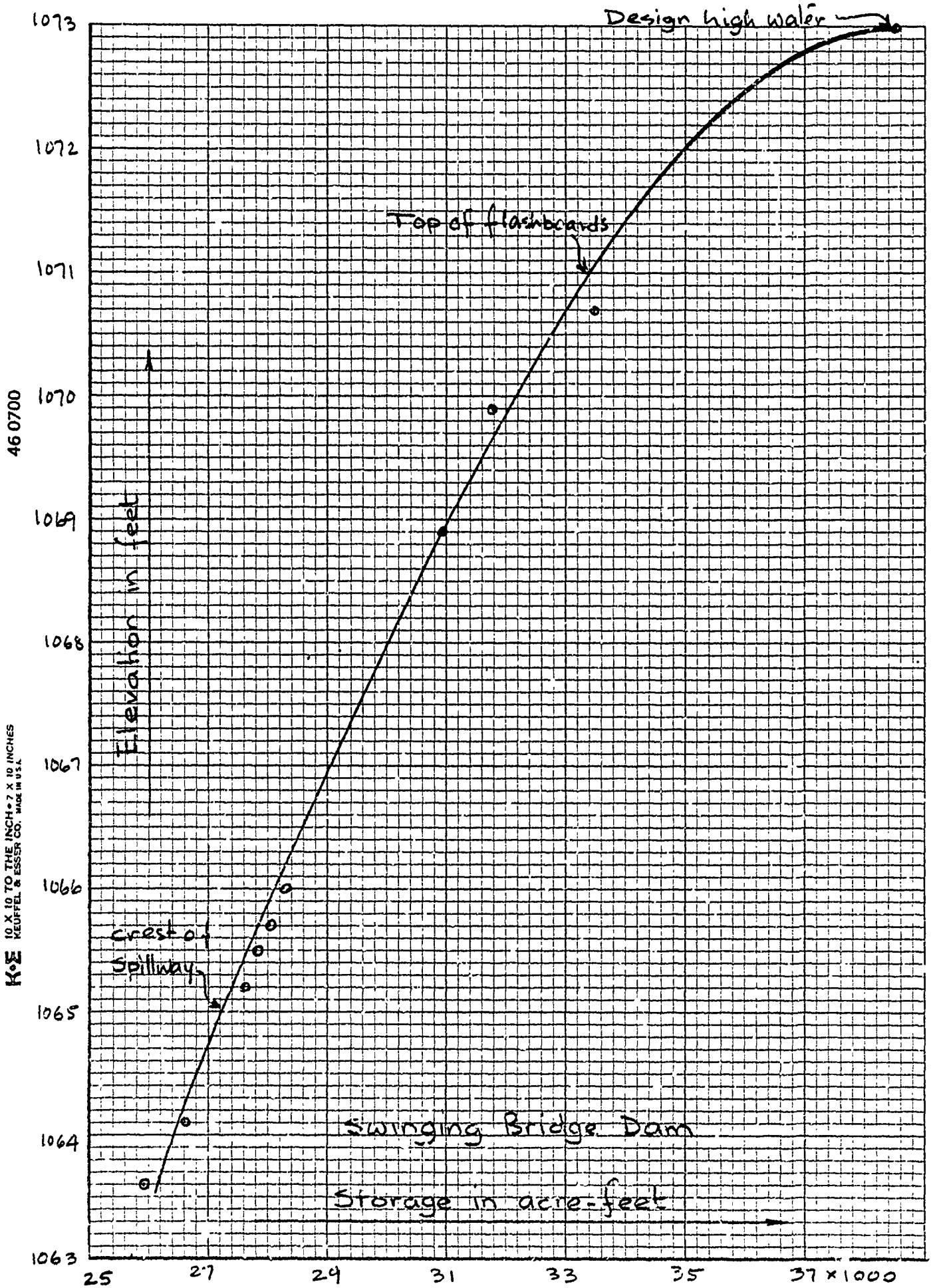
PMF = 2 × 23,900 = 47,800 cfs.

SWINGING BRIDGE

STORAGE CAPACITY CURVE

Elevation (feet)	storage (acre-feet)
1063.0	25691
1063.2	25852
1064.1	26634
1065.2	27577
1065.5	27830
1065.7	28014
1066.0	28267
1068.9	30889
1069.9	31809
1070.7	33511
1073.0	38500

Capacity figures given above are based on zero storage at minimum operating pool level El. 1010.0


Design high water
Top of flashboards
crest of spillway
Elevation in feet
Swinging Bridge Dam
Storage in acre-feet
1073
1072
1071
1070
1069
1068
1067
1066
1065
1064
1063
25
27
29
31
33
35
37 x 1000
46 0700
K&E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

SWINGING BRIDGE

Spillway Rating Curve

1. Floodgates 2. Spillway

H = Head, L = Length, C = Coefficient of discharge, Q = discharge

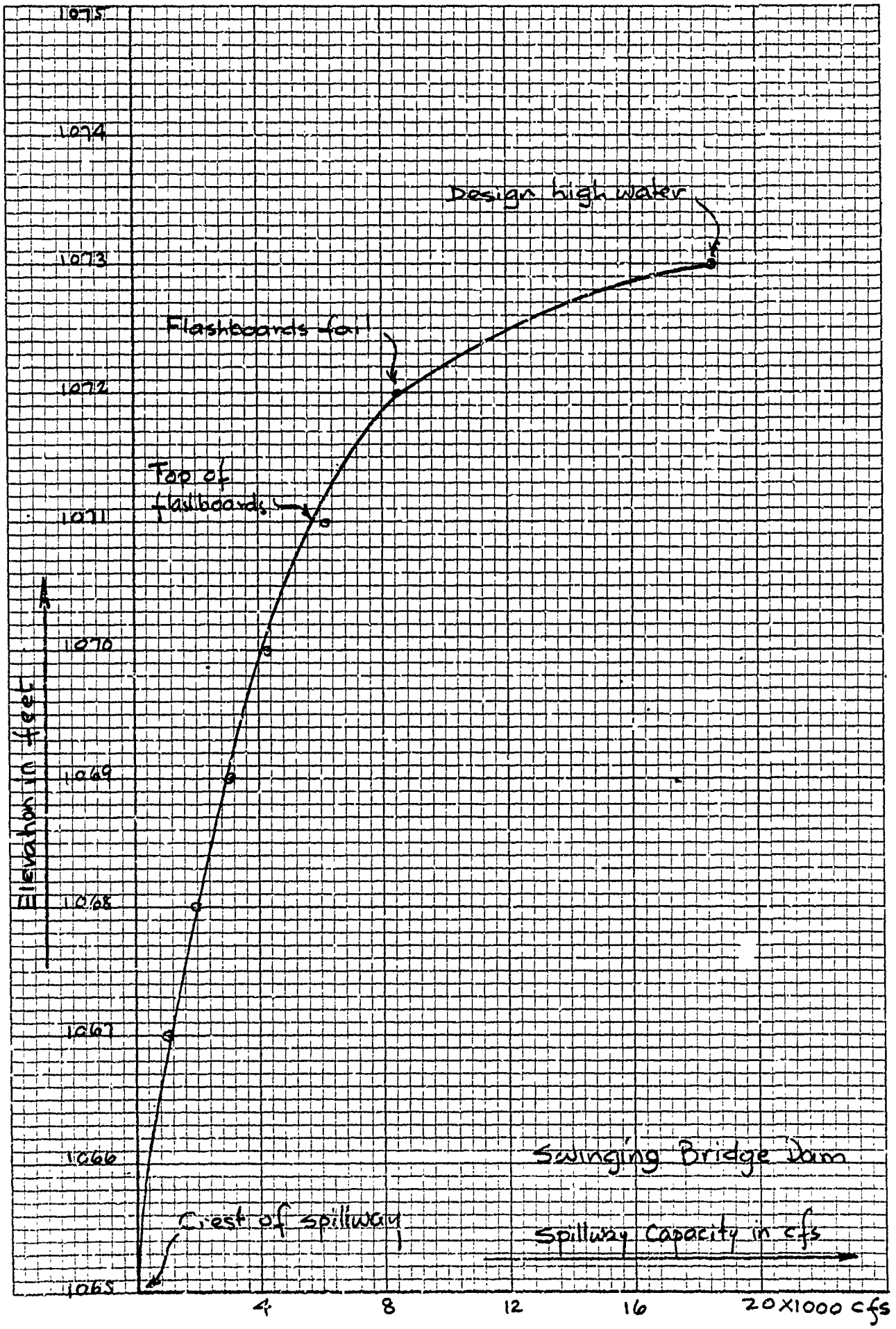
5 floodgates each 22.6' wide. 6' high collapsible flashboards on spillway.

$Q = CLH^{3/2}$

Elevation (feet)	H_1 (feet)	C	L_1 (feet)	Q_1 (cfs)	H_2 (feet)	C	L_2 (feet)	Q_2 (cfs)	Q_1+Q_2 Q cfs	Remarks
1066	1	3.3	113	373	0		122			
1067	2	3.3	113	1055	0		122			
1068	3	3.4	113	1996	0		122			
1069	4	3.4	113	3074	0		122			
1070	5	3.4	113	4295	0		122			
1071	6	3.5	113	5813	1	3.3	122	403	6216	
1072	7	3.5	113	7325	2	3.3	122	1139	8464	Flashboards fail
1073	8	3.5	113	8949	3	3.5	122	9662	18610	

Flashboard collapses with 2' of water over flashboards.

Values of C assumed for simplification.



OVERTOPPING

$Q = CLH^{3/2}$ where Q = discharge in cfs
C = Coefficient of discharge
L = Length of floodgates & spillway
H = Head

For $\frac{1}{2}$ PMF = SPF

Q = 23,900 cfs, C = 3.5, L = 235 ft., H = ?

$23{,}900 = 3.5 \times 235 \times H^{3/2}$

H = 9.5 feet.

Elevation at H = 9.5' is 1065.0 + 9.5 = 1074.5 ft.

For PMF

Q = 47,800 cfs, C = 3.5 ft., L = 235 ft, H = ?

$47{,}800 = 3.5 \times 235 \times H^{3/2}$

H = 15 feet

Elevation at H = 15 ft is 1065.0 + 15 = 1080 ft.
Top of dam

LIST OF REFERENCES

APPENDIX E

APPENDIX E

REFERENCES

1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.

2) Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972 (U.S. Department of Agriculture).

3) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.

4) T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1965.

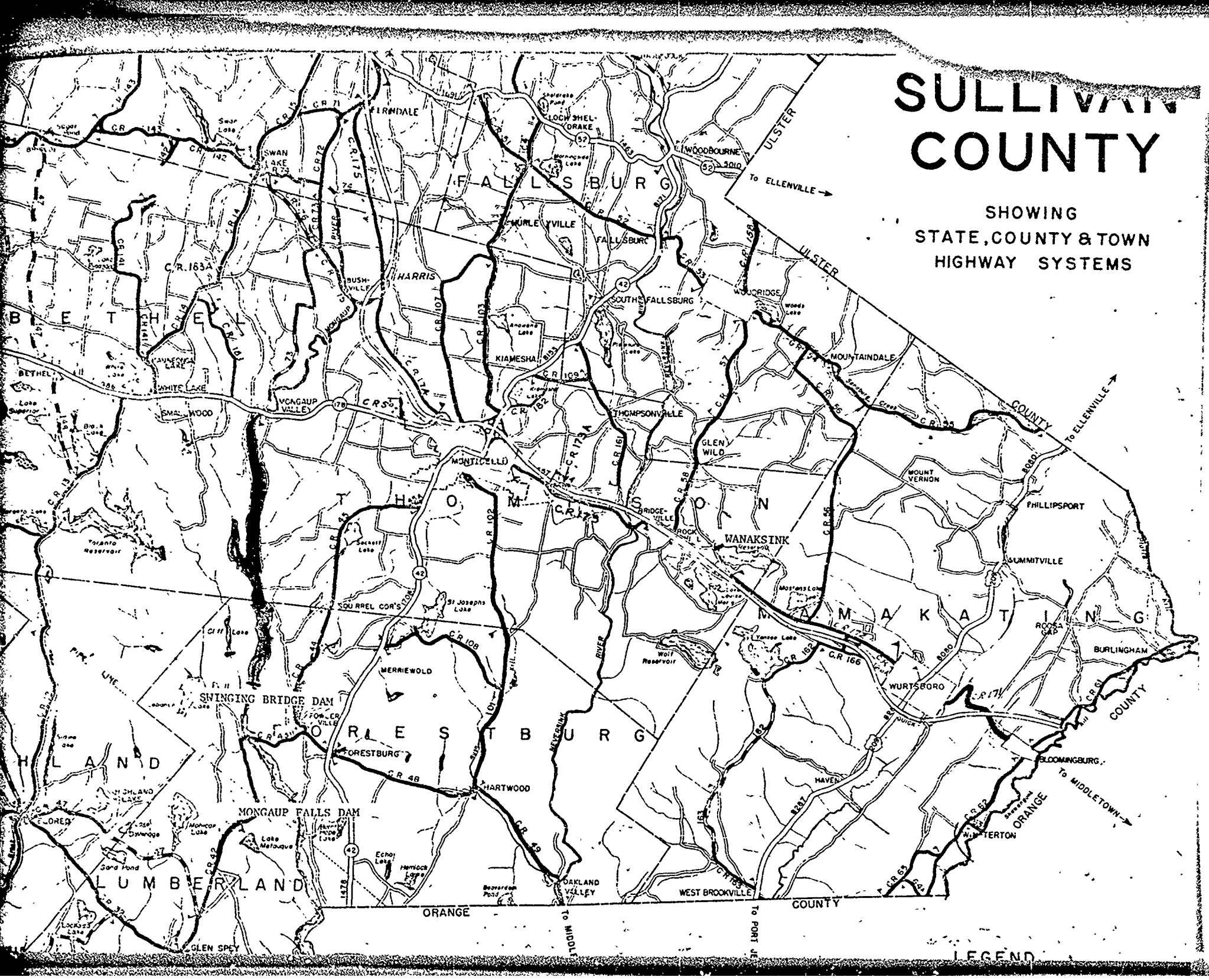
5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.

6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

APPENDIX F

DRAWINGS


SULLIVAN COUNTY
SHOWING
STATE, COUNTY & TOWN
HIGHWAY SYSTEMS
FALLSBURG
BETHEL
THOMPSON
MAMAKATING
LUMBERLAND
HIGHLAND
FORESTBURG
ULSTER
ORANGE
COUNTY
To ELLENVILLE
To MIDDLETOWN
To PORT JE
FERNDALE
LOCH SHELDRAKE
WOODBOURNE
SWAN LAKE
HURLEYVILLE
FALLSBURG
HARRIS
BUSH-VILLE
SOUTH FALLSBURG
WOODRIDGE
MOUNTAINDALE
KIAMESHA
BETHEL
WHITE LAKE
MONGAUP VALLEY
SMALLWOOD
THOMPSONVILLE
GLEN WILD
MONTICELLO
BRIDGE-VILLE
MOUNT VERNON
PHILLIPSPORT
WANAKSINK
SUMMITVILLE
SQUIRREL COR'S TOP
ROSA GAP
BURLINGHAM
WURTSBORO
SWINGING BRIDGE DAM
MERRIEWOLD
FORESTBURG
HARTWOOD
MONGAUP FALLS DAM
HAVEN
BLOOMINGBURG
OAKLAND VALLEY
WEST BROOKVILLE
GLEN SPEY
LEGEND
NEVERSINK RIVER
MONGAUP RIVER
C.R. 163A
C.R. 175
C.R. 173A
C.R. 108
C.R. 48
C.R. 49
C.R. 166
C.R. 171
C.R. 62
C.R. 63

TOPOGRAPHIC MAP

L. C. Huber

ORANGE AND ROCKLAND UTILITIES, INC.

one blue hill plaza, pearl river, new york, 10965 914-352-6000

writer's direct dial number 914-627-2420

December 7, 1978

Mr. James D. Hebson, Regional Engineer
New York Regional Office
Federal Energy Regulatory Commission
26 Federal Plaza
New York, New York 10007

Subject: Emergency Action Plan in the Event of Dam Failure at Project Nos. 2578, 2592 and 2605

Dear Mr. Hebson:

In accordance with your letter dated October 16, 1978, enclosed are three (3) copies of our revised "Monitoring and Emergency Action Plan, Mongaup River Hydroelectric Facilities." The plan provides a detailed procedure for notification of the proper authorities in the event of an emergency, including a list of telephone numbers of persons to be contacted. A contingency plan for alternate means of communication as well as documentation of correspondence with the New York State Police are also attached.

The Company Duty Officer changes each week and a copy of the Duty Officer schedule is provided to the System Operator's office. By copy of this letter the revised Emergency Action Plan is being transmitted to the Superintendent-Hydro Maintenance for immediate posting in his office. All subsequent revisions shall be likewise forwarded to him.

The revised plan includes a list of parties to be notified in the event of an emergency with the State Police having the primary responsibility and authority to effect any orderly evacuation of the areas of potential flooding. Since Orange and Rockland Utilities is the only operator of water-related facilities along the Mongaup River subject to potential flooding in the event of dam failure, the notification of other such operators is not applicable.

The Company's rigid inspection program, which is summarized in the Emergency Action Plan, affords us the opportunity to determine where repairs are required well in advance of the developing the critical stage. Materials necessary to effect such repairs on a

timely basis are on hand or are readily available in the area. Therefore, we do not feel the necessity to stockpile additional materials for emergency repairs.

Coordination of flows based on weather forecasts is included in instructions to System Operators. This flow coordination is designed to reduce the risk and amount of potential flooding in the downstream areas.

If we can be of further assistance to you regarding this matter, please do not hesitate to contact us.

Very truly yours,

Frank E. Fischer
Vice President

BZBjr/ct
Atts.

cc: B. Muthig, Capt. (NYS Police)

bcc: T. A. Griffin, Jr.
K. B. Field
B. Z. Baxter, Jr.
F. J. Kiernan (4 copies for distribution)
J. F. Kragh
W. H. Smith
J. O. Trudeau
K. D. Archer

ORANGE AND ROCKLAND UTILITIES, INC.

MONITORING AND EMERGENCY ACTION PLAN

MONGAUP RIVER HYDROELECTRIC FACILITIES

(Revised December 1, 1978)

Inspection Procedures Used To Monitor Condition Of Dams

Swinging Bridge, Mongaup and Rio dams are inspected daily by attendant-operators.

Toronto, Cliff Lake and Lebanon dams are inspected on Monday, Wednesday and Friday of each week by Hydro Maintenance crew members.

Each dam will be inspected once a year by a licensed Civil Engineer.

All dams are inspected every five years by consulting engineers representing the Company Bond Holders.

Other Monitoring Procedures

Pond elevations at Swinging Bridge, Mongaup and Rio are recorded by operators at these plants and relayed to Orange and Rockland System Operators at least every 4 hours during normal working hours and 24 hours per day during times of severe floods. When the new Energy Control Center goes into service in mid-1979, these elevations will be monitored continuously and automatically logged hourly at the System Operator's office in Spring Valley, New York.

Instructions to System Operators and Superintendent-Hydro Maintenance

In case of major floods (over 4 inches of rain in 24 hours or 6 inches in 48 hours), or when the in-flow at Swinging Bridge exceeds 2,000 c.f.s., Superintendent-Hydro Maintenance is instructed to close Toronto reservoir gates (if open) and start opening Swinging Bridge

flood gates at a rate which will hold the Swinging Bridge pond elevation at Elev. 1070 or less.

If the Swinging Bridge pond water elevation rises to Elev. 1071, the top 1.2 feet of flashboards will release over the 125 foot length of boards. When this condition occurs the Superintendent-Hydro Maintenance shall notify the System Operator. The System Operator shall notify the New York State Police that a possible emergency condition is imminent and request that Police stand by, but take no action until further notice. If this release by the top 1.2 feet of flashboards does not cause a drop in the elevation of the Swinging Bridge pond, or if the pond again rises to Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the houses in Mongaup Village at the lower end of the Mongaup River. The System Operator shall notify the Company Duty Officer, Manager-Electric Production, and Security Manager of the emergency condition and the action taken. The System Operator shall notify the New York Regional Engineer of the Federal Energy Regulatory Commission or his alternate.

If Swinging Bridge pond level continues to rise to above Elev. 1072, the remaining 5.0 feet of flashboards will be released and the maximum spillway capacity will then be available. The sill of this spillway is at Elev. 1065.

The operation of the entire flashboard system with all gates wide open should control the Swinging Bridge pond level for any anticipated flood. If after the operation of the entire flashboard system the pond level does not drop below Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the remaining endangered properties located immediately down-

stream of the Mongaup dam and the Rio recreation area. Notification of the Duty Officer, Manager-Electric Production, Corporate Communications, and Security Manager shall also be accomplished.

In the event, during an emergency condition, the Superintendent-Hydro Maintenance cannot make telephone contact with the System Operator, he shall use the Company two-way radio system. If the System Operator cannot make telephone contact with the State Police, he shall request a messenger with a radio vehicle be immediately dispatched from the Company's Western Division Operations Center in Middletown, New York to go directly to the State Police headquarters, also located in Middletown, to notify them of the emergency condition. The messenger shall remain at police headquarters to maintain direct radio contact between the Superintendent-Hydro Maintenance, System Operator, and the State Police.

MONGAUP RIVER HYDROELECTRIC FACILITIES

EMERGENCY ACTION PLAN

NOTIFICATION LIST

New York State Police		(914) 343-1424
Superintendent-Hydro Maintenance Joseph B. Case	Office: Home:	(914) 856-2109 (914) 754-8271
Manager-Electric Production Frank J. Kiernan	Office: Home:	(914) 352-6000, X-441 (914) 342-0521
Security Manager John F. Kragh	Office: Home:	(914) 352-6000, X-558 (914) 496-4964
Corporate Communications John P. Murphy	Office: Home:	(914) 627-2473 (914) 942-0246
Federal Energy Regulatory Commission		
New York Regional Engineer James Hebson	Office: Home:	(212) 264-3687 (201) 998-2845
Chief Civil Engineer (Alternate) Martin Inwald	Office: Home:	(212) 264-3687 (516) 285-5964
Operations Duty Officer	(See Operations Duty Officer Schedule and Guidelines)	

In answering this, please use the same subject heading as on this letter

Subject Monitoring and Emergency Action Plan

To FILE

From B. Z. Baxter, Jr.

cc: Mr. F. E. Fischer
Mr. J. Kragh
Mr. K. B. Field

July 14, 1978

On July 7, 1978 a meeting was held at the New York State Police Headquarters, Troop F, in Middletown, New York to review our June 30, 1978 submittal of subject plan to the Federal Energy Regulatory Commission. Attendees were J. Kragh (O&R), B. Z. Baxter, Jr. (O&R), B. Muthig, Capt. (NYS Police) and J. McMahon, Lt. (NYS Police).

Since we had forwarded a copy of the plan to the NYS Police prior to the meeting, only a short discussion as to the purpose of the plan and the function of the State Police was required. We advised that they were the only group being asked to coordinate this Emergency Action Plan in the event implementation was necessary and we would forward them a list of residences not controlled by O&R that would be affected in the Mongaup Village area. The State Police felt that since there were few residences involved, notification would not be difficult.

They were informed that any changes in the Emergency Action Plan would be forwarded to them as they occurred.

The meeting was highly productive since we will be able to obtain their cooperation.

B. Z. Baxter

BZBjr/ct

B. Z. Baxter, Jr.

914-627-2609

July 17, 1978

Blake Muthig, Captain
New York State Police
Troop F
Middletown, New York 10940

Subject: Monitoring and Emergency Action Plan
Mongaup River Hydroelectric Facilities

Dear Captain Muthig:

As agreed during our July 7, 1978 meeting, attached is a list of residences in the Mongaup Village area not controlled by Orange and Rockland which could be flooded due to upstream dam failure. We also attach a drawing showing location of the homes with respect to the expected area of flooding.

In the event of any changes in the Emergency Action Plan, you will be promptly notified.

Very truly yours,

B. Z. Baxter, Jr.
Assistant Vice President

BZBjr/ct
Atts.

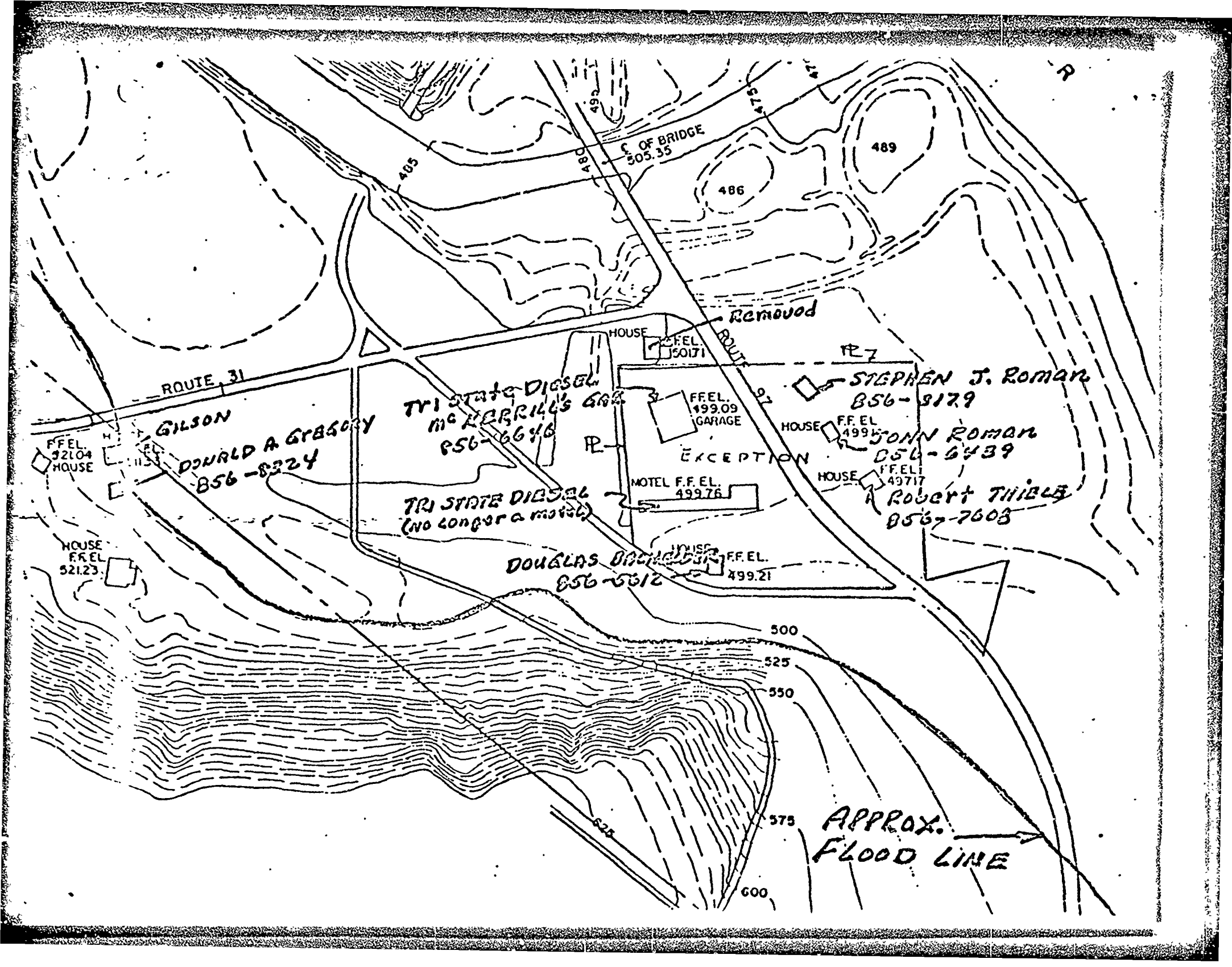
cc: Mr. J. Kragh

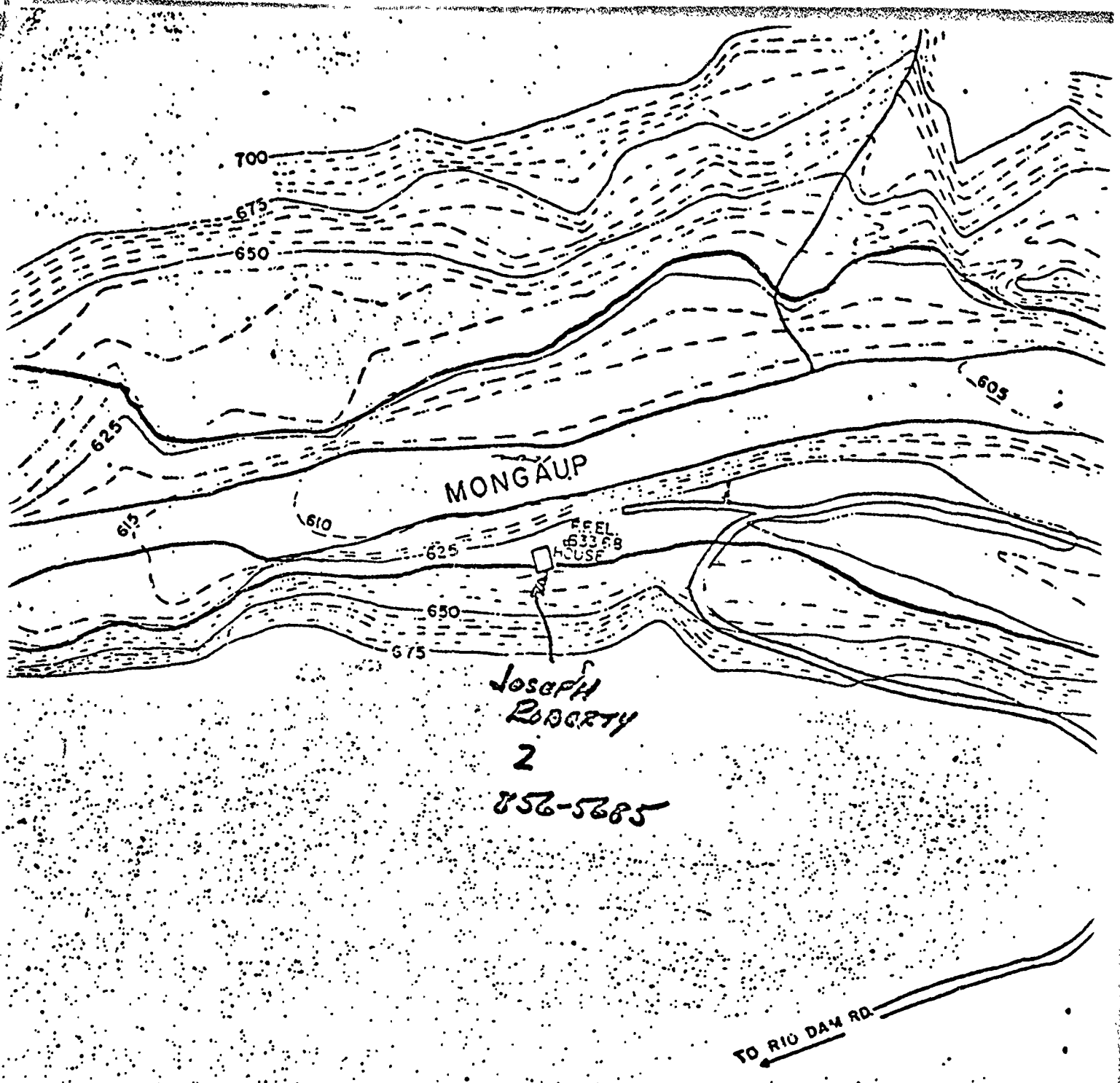
bcc: Mr. F. E. Fischer
Mr. K. B. Field

Mongaup Village Residences

Not Controlled By O&R

Donald A. Gregory	856-8324
Tri State Diesel McKerrill's Garage	856-6646
Gilson	No Phone Listed
Douglas Bachelder	856-5612
Stephen J. Roman	856-3179
John Roman	856-6439
Robert Thiele	856-7608
Joseph Roberty	856-5685


ROUTE 31
ROUTE 9
℄ OF BRIDGE
505.35
Removed
HOUSE
F.F.EL 501.71
F.F.EL. 499.09 GARAGE
EXCEPTION
MOTEL F.F.EL. 499.76
TRI STATE DIESEL
(NO LONGER A MOTEL)
HOUSE F.F.EL 521.23
F.F.EL 521.04 HOUSE
GILSON
DONALD A GREGORY
856-8224
TRI STATE DIESEL
McLARRIAN'S GRG
856-6616
STEPHEN J. ROMAN
856-8179
HOUSE F.F. EL 499.5
JOHN ROMAN
856-6439
HOUSE F.F.EL 497.17
ROBERT THIELE
856-7603
DOUGLAS DITCHDIGGER
856-5612
F.F.EL. 499.21
APPROX. FLOOD LINE
485
480
495
475
489
486
500
525
550
575
600


700
675
650
625
605
MONGAUP
610
615
625
F.F.EL.
633.68
HOUSE
650
675
Joseph
Rodgers
2
856-5685
TO RIO DAM RD.

COMPANY OPERATIONS
DUTY OFFICER
GENERAL GUIDELINES

PURPOSE

To provide for the availability of a person of sufficient rank to act in the capacity of Company spokesman and provide high level management direction, if required in the event of an incident or accident within the Company which would have a significant impact in terms of our customers, the general public, regulatory agencies, news media and other interested publics. This is consistent with our Company Policy of providing continuous service to our customers in a safe and efficient manner.

To provide an equitable distribution of Operating Department responsibilities during those periods outside of the normal business hours.

To provide the opportunity for the exposure of the Duty Officer to all facets of operations, thereby developing understanding, appreciation and flexibility of personnel within the Company.

GENERAL GUIDELINES

1. Copies of the Duty Officer Schedule for Company operations will be made available to the Service Operator Supervisor and Service Operators to facilitate contacting the appropriate person when an incident or accident occurs which may have a significant impact on the Company.

2. Persons scheduled for duty may change with other parties on the Duty Officer Schedule and will be obligated to inform the Service Operator Supervisor of such change.

3. The availability of the Duty Officer will be required during the entire week that the person is scheduled. Availability is not construed to mean that the person must stay at home by the telephone. However, it does mean that the person may be contacted in a timely fashion.

4. The person designated as Duty Officer for the week will act as the Company spokesman concerning any incident or accident that occurs during that week, until such time as another appropriate individual becomes available to act as the Company spokesman.

5. The availability of a Duty Officer will not supersede or change established procedures for emergency notification of functionally responsible Officers or other personnel.

GENERAL GUIDELINES - (Continued)

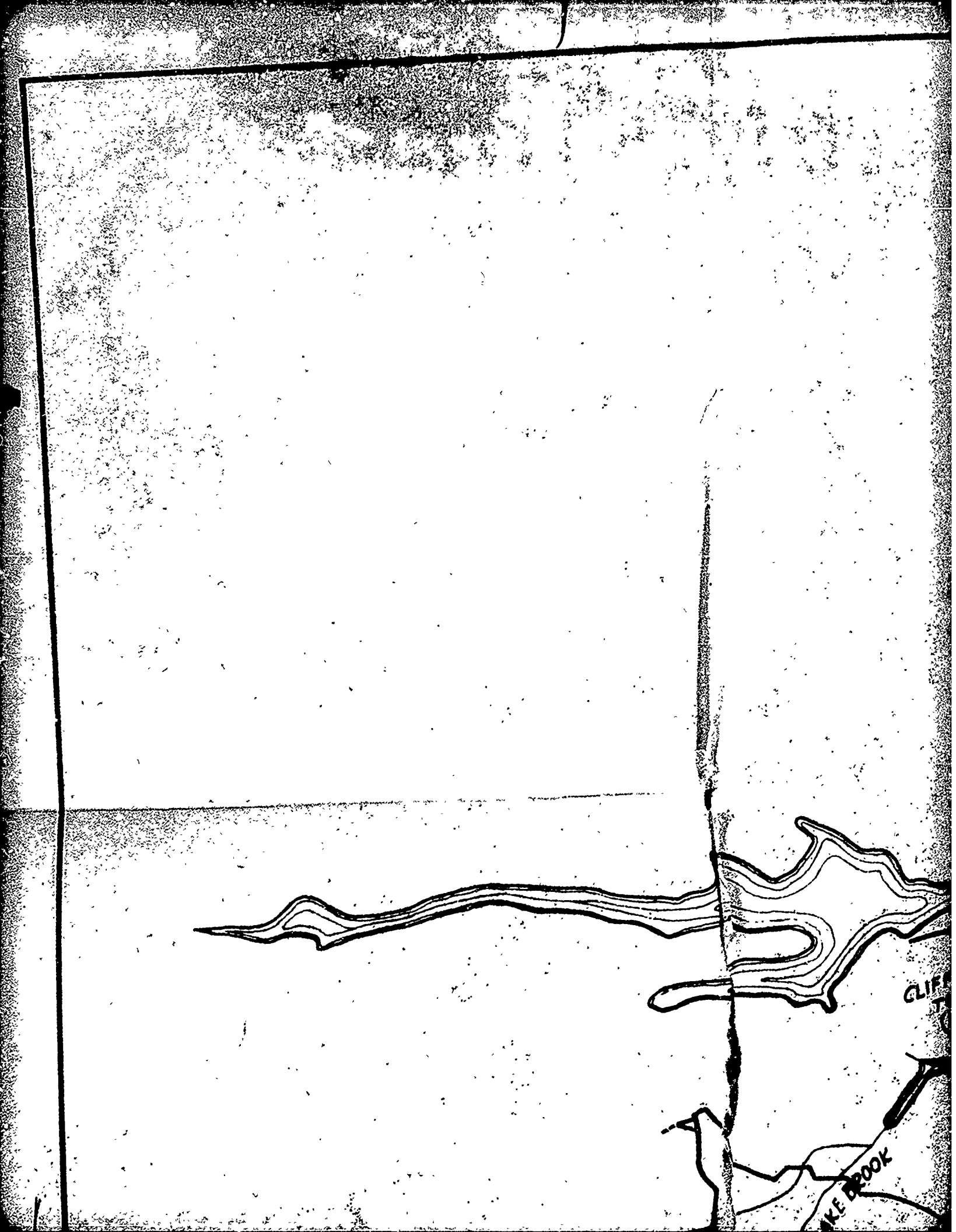
6. The Duty Officer shall act as the liaison authority across all departments, such as Transportation, Stores, etc. during the period outside of normal business hours. Problems which may develop after the standard Operating Procedures have been exhausted at lower levels of management, concerning the coordination of support services will be resolved by the Duty Officer.

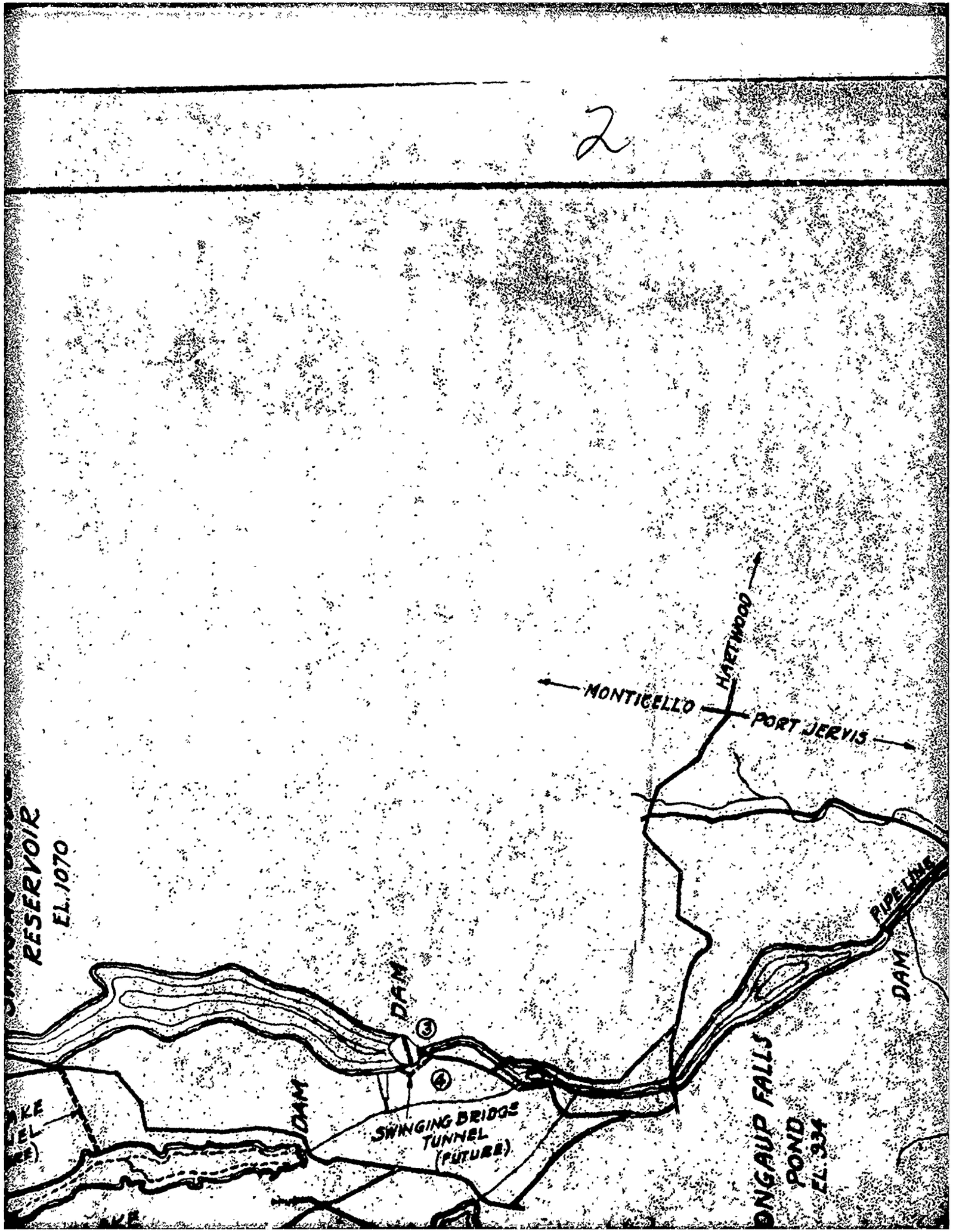
7. Included with the Duty Officer Schedule are Emergency Procedures that are to be followed either by the Standby Duty Supervisor and/or persons within the operating departments in compliance with established requirements. It shall be the responsibility of the Duty Officer to ensure that these requirements are accomplished in a timely manner.

List of Drawings

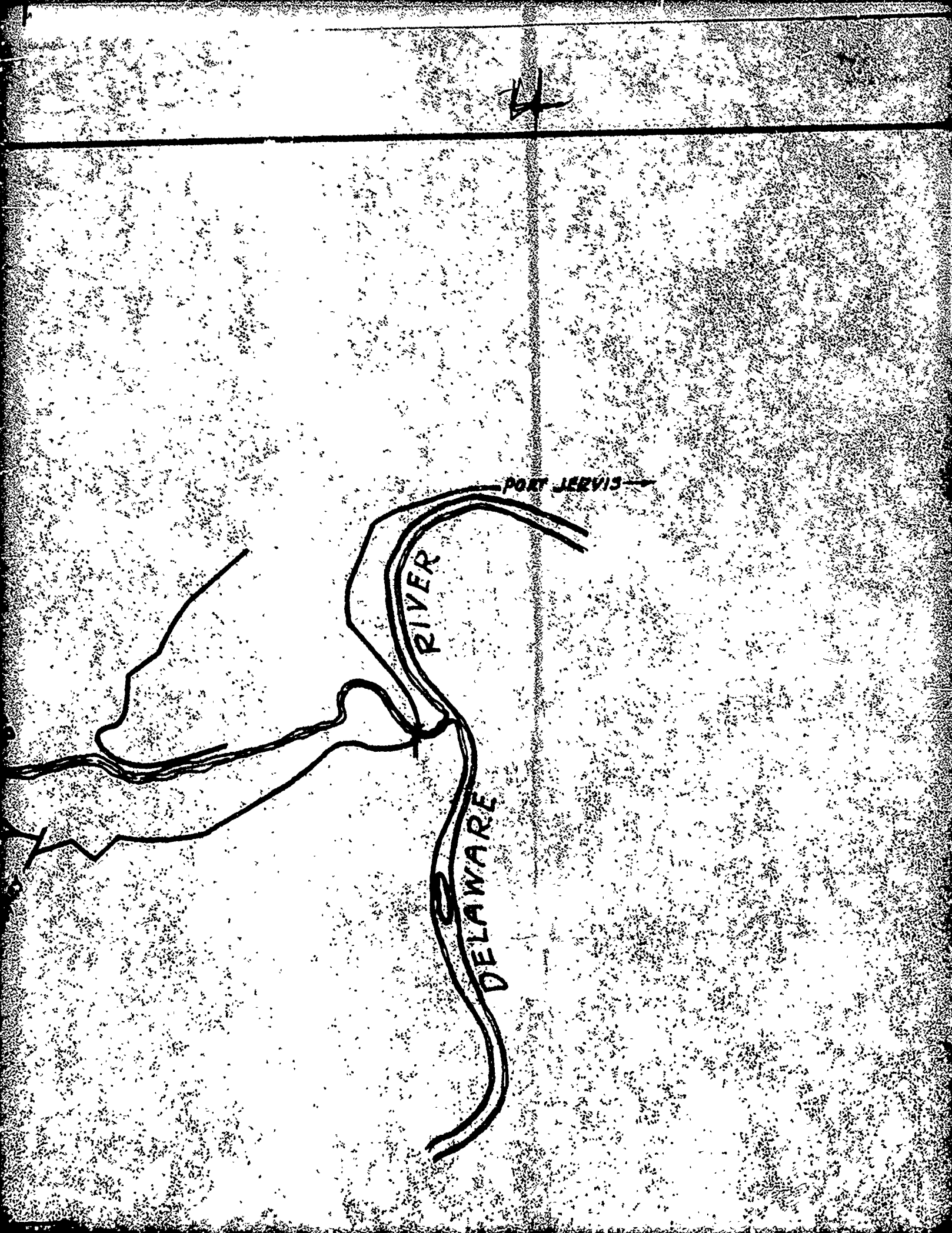
Swinging Bridge Dam

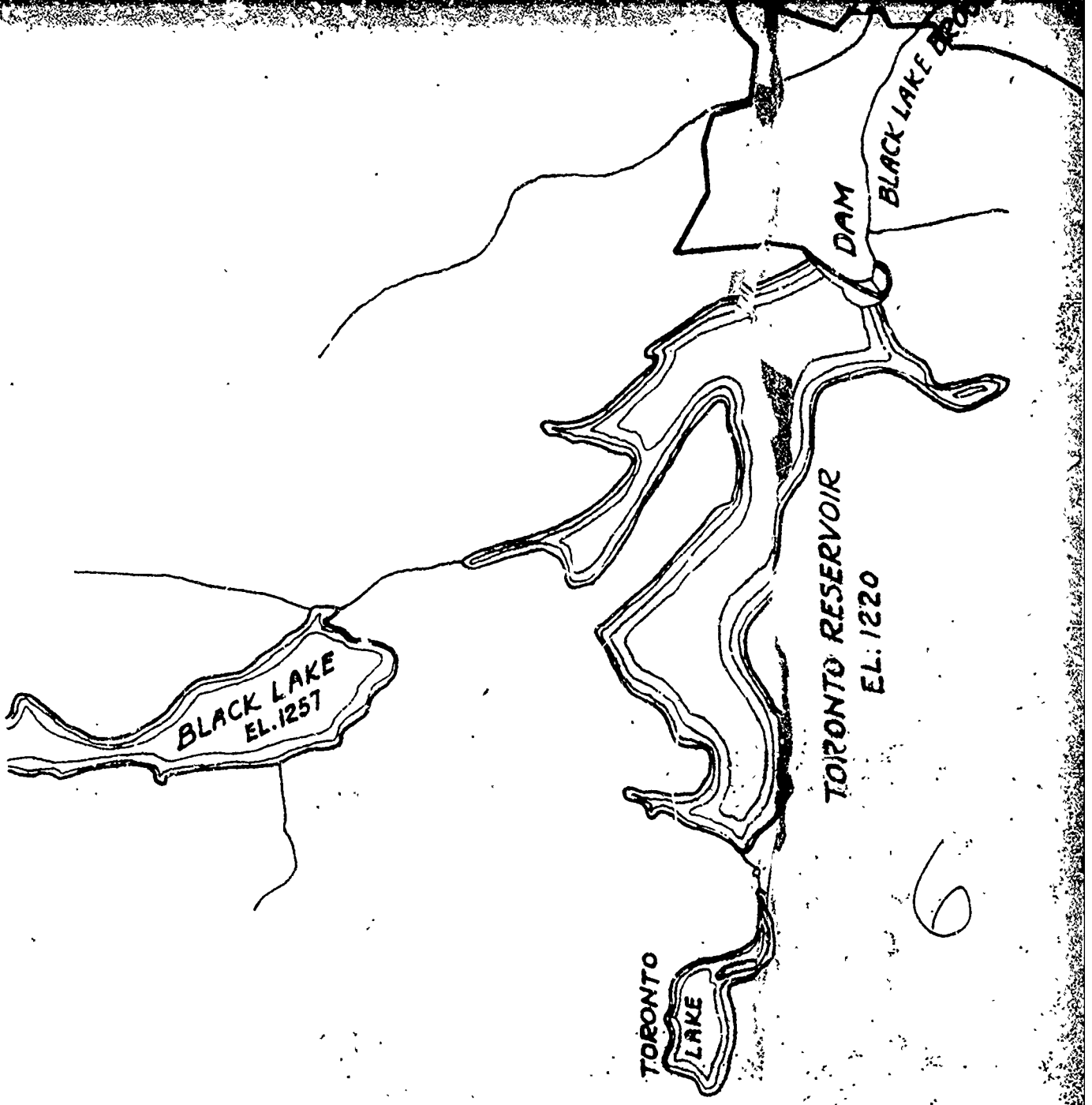
	Drawing Number
Developments on Mongaup River	1300-50
General Plan	-
Borings	KK3-16
Dam	KK3-17
Spillway	KK3-18
Intake	KK3-19
Gate Tower	KK3-21
Conduit	KK3-25
Conduit Outlet	KK3-27
Powerhouse - General Plan (Generator #1)	KK3-28

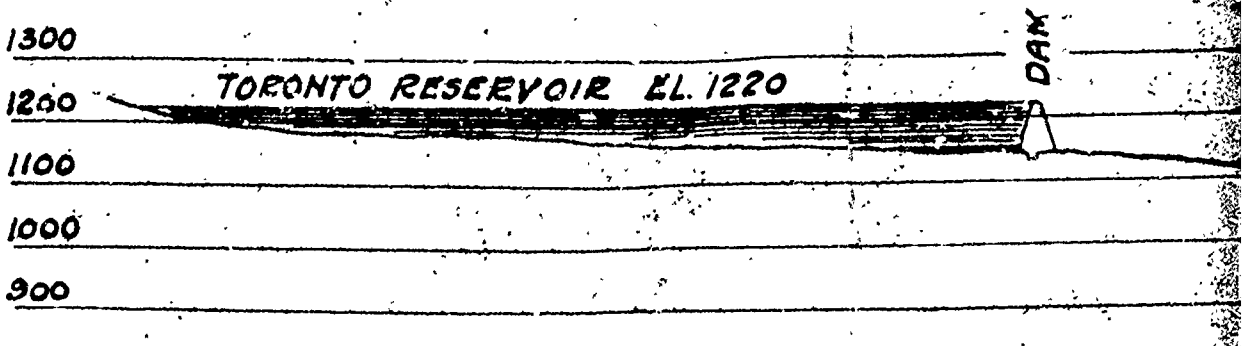



RESERVOIR
EL. 1070
DAM
③
④
DAM
SWINGING BRIDGE
TUNNEL
(FUTURE)
MONTICELLO
HARTWOOD
PORT JERVIS
PIPE LINE
DAM
POND
EL. 934

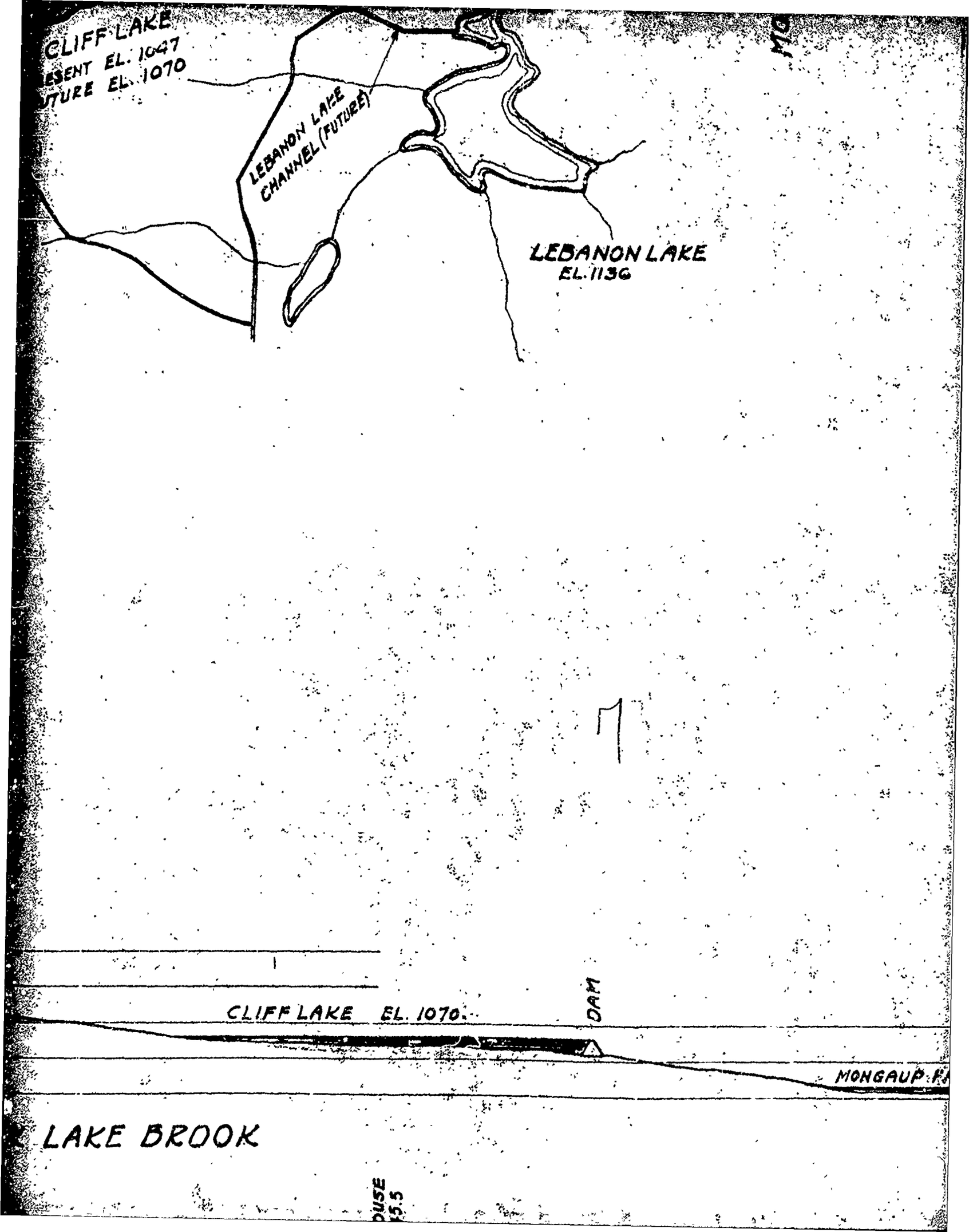

1231
DAM
MONGAUP
PIPE LINE
RIO POND
EL. 815
1273


PORT JERVIS
DELAWARE
RIVER





PROFILE ON BLA


CLIFF LAKE
ESENT EL. 1047
UTURE EL. 1070
LEBANON LAKE CHANNEL (FUTURE)
LEBANON LAKE
EL. 1136
CLIFF LAKE EL. 1070
DAM
MONGAUP R
LAKE BROOK

① RIO PO
② MONGA
③ SWING
④ SWING

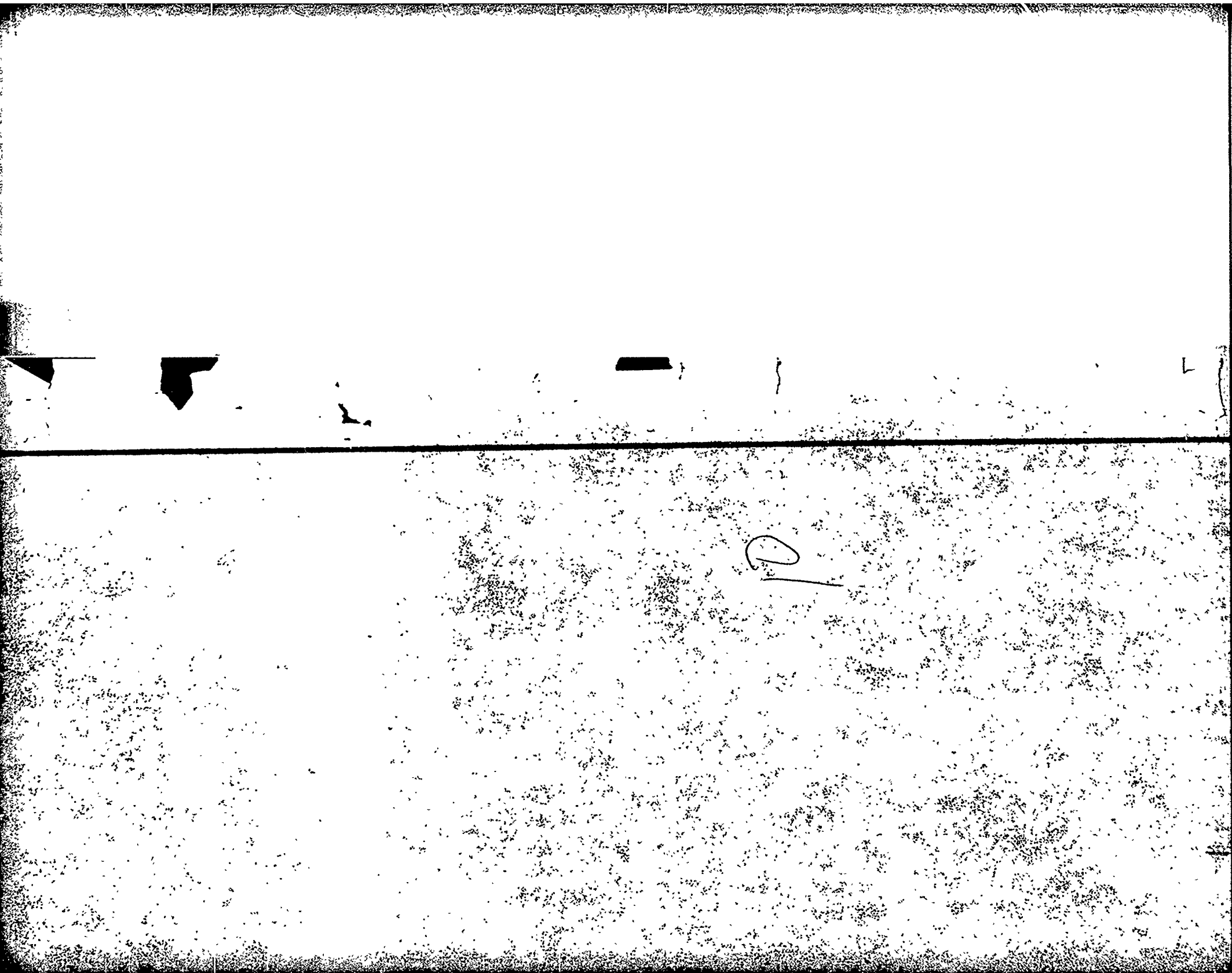
9

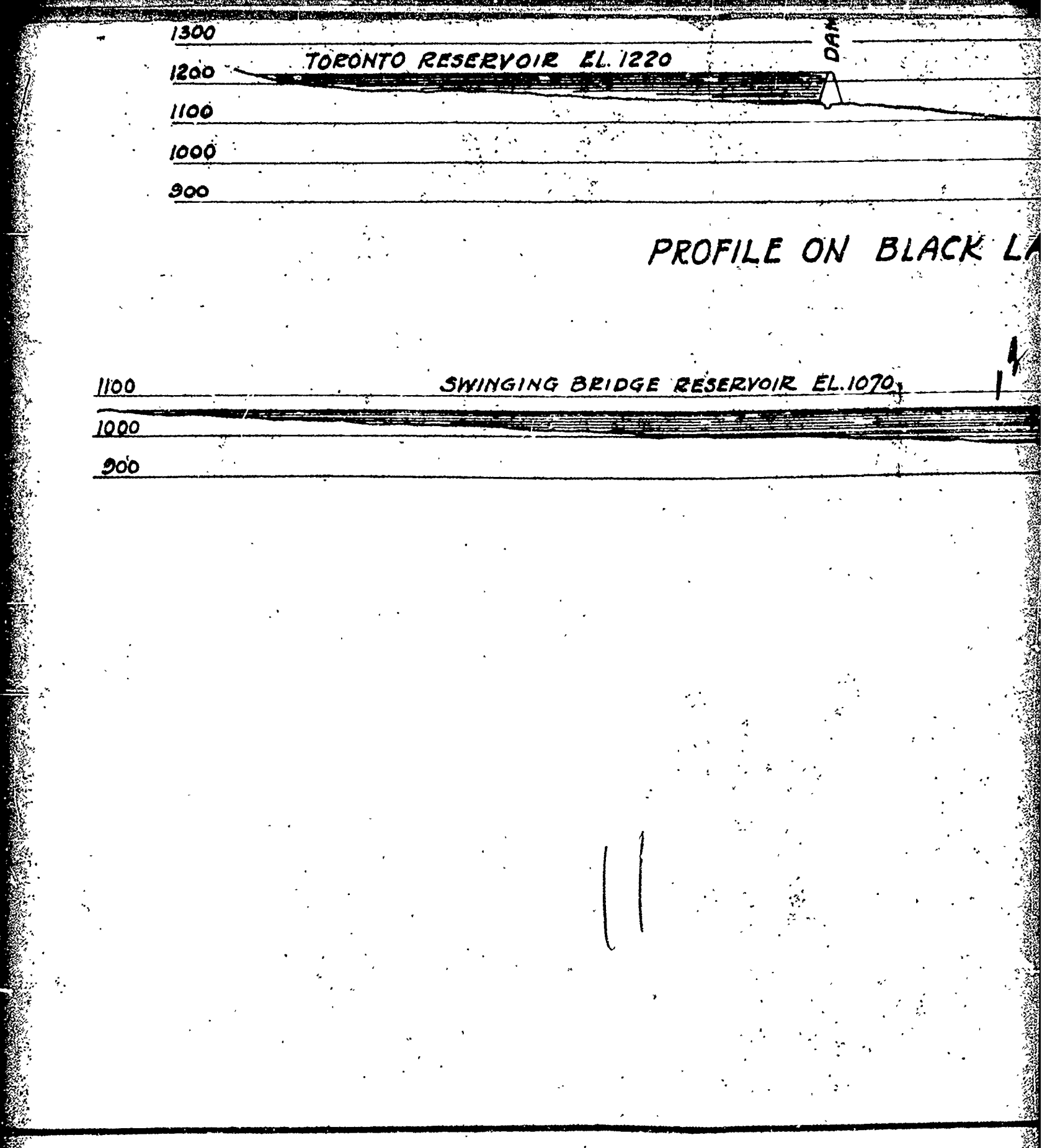
FALLS POND EL. 934. . .

OWERHOUSE - 10,000 K.W.
UP FALLS POWERHOUSE - 4000 K.W.
ING BRIDGE POWERHOUSE NO. 1 - 5000 K.W.
ING BRIDGE POWERHOUSE NO. 2 - 5000 K.W. (FUTURE)

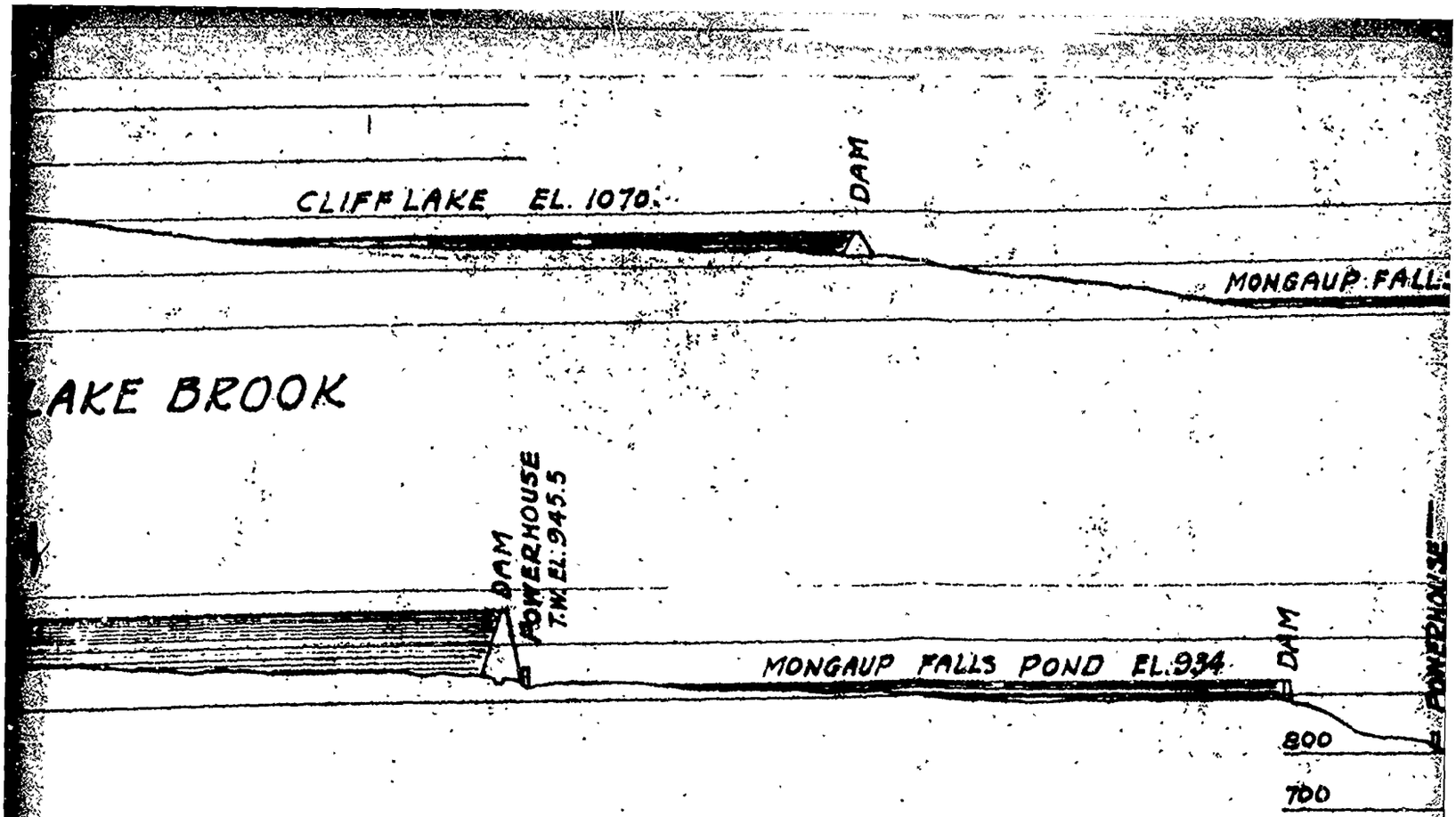
9

10



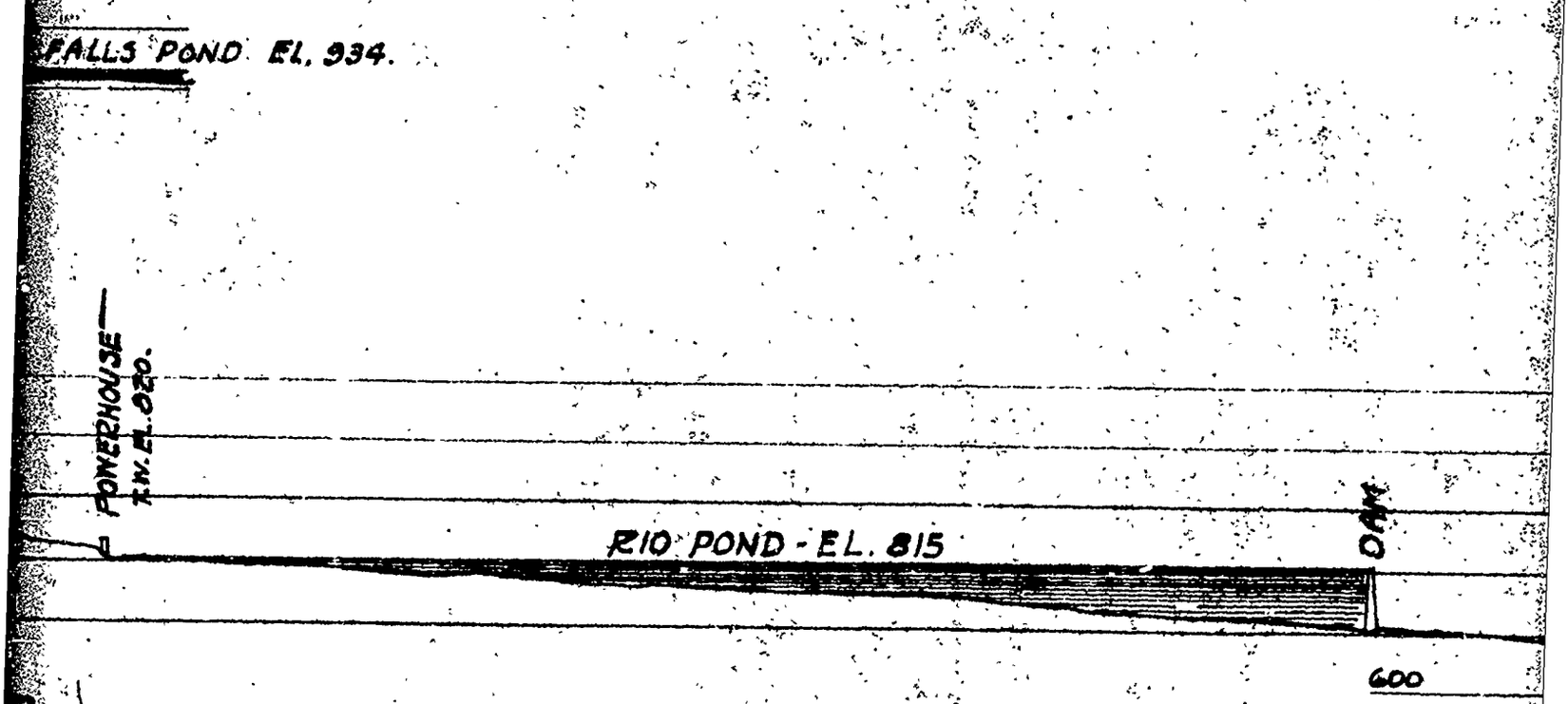


PROFILE ON BLACK L



PROFILE ON MONGAUP RIVER

12



13

POWERHOUSE
T.W.EL. 430

ROCKLAND
N
DEVELOPMENT
GEN

CHAS. T. M
201 DEVONSHIRE ST.

7-14-38	General Revi

IN CHARGE W. F. C.			S
DRAWN	TRACED	CHECKED	D
R.A.K.			

14

ROCKLAND LIGHT & POWER CO.

NYACK-N.Y.

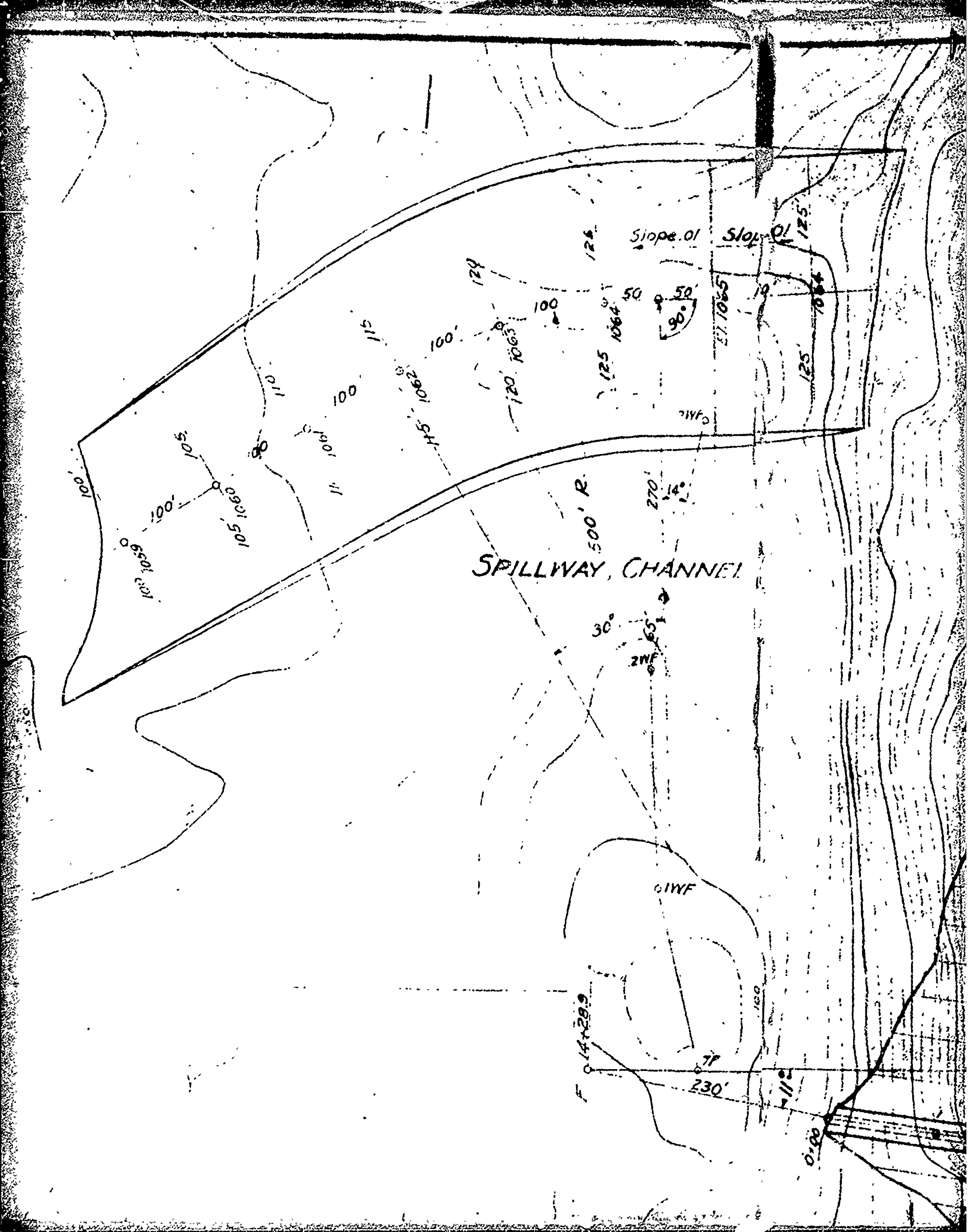
DEVELOPMENTS ON MONGAUP RIVER
GENERAL PLAN

CHAS. T. MAIN, INC., ENGINEERS.
301 DEVONSHIRE ST. BOSTON, MASS. U.S.A.

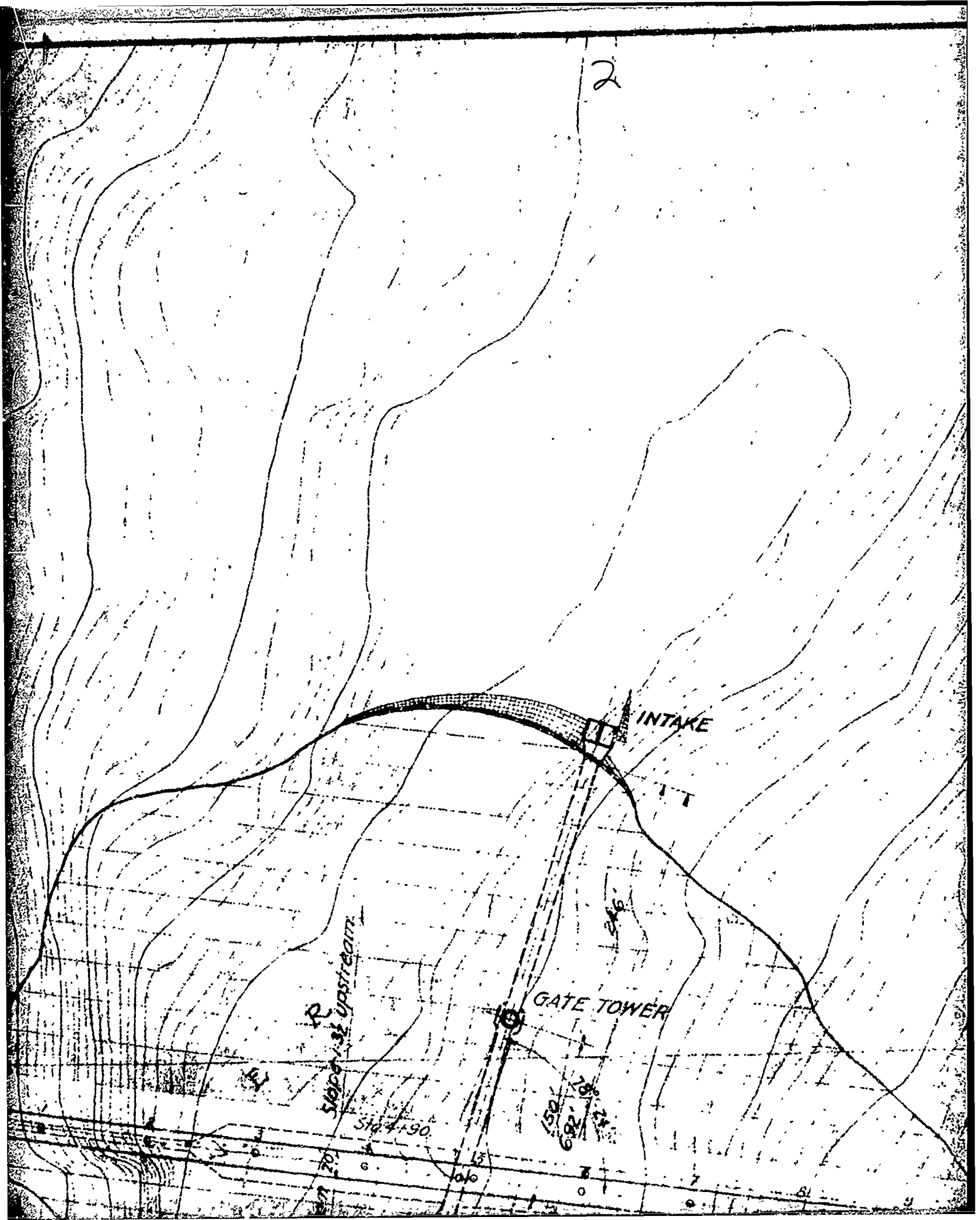
REVISIONS	
7-14-38	General Revisions

IN CHARGE W.F.U.			SCALE 1 in. = 300 Ft.	1300-50
DRAWN	TRACED	CHECKED	DATE July 7-1938	
R.A.K.				

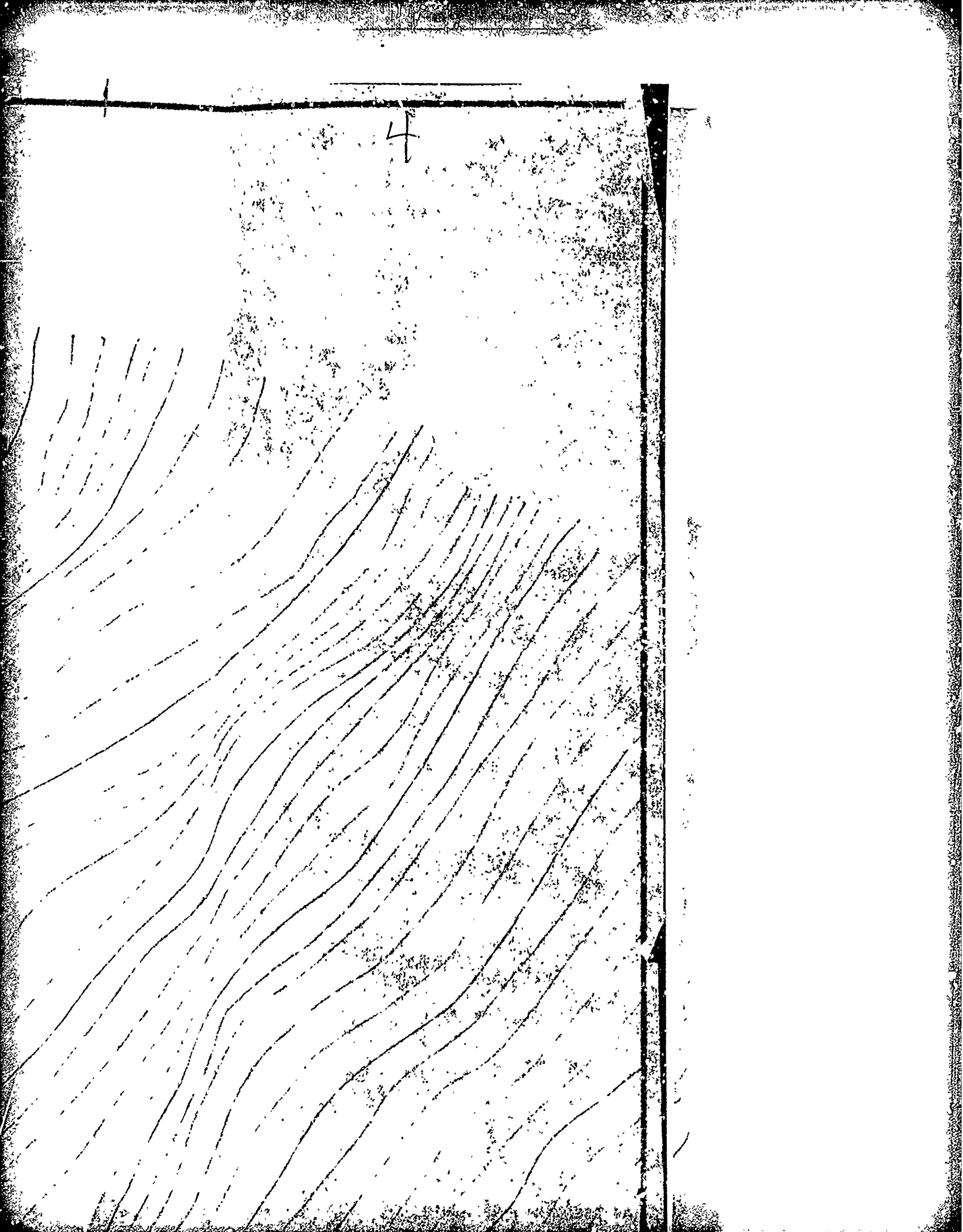
15

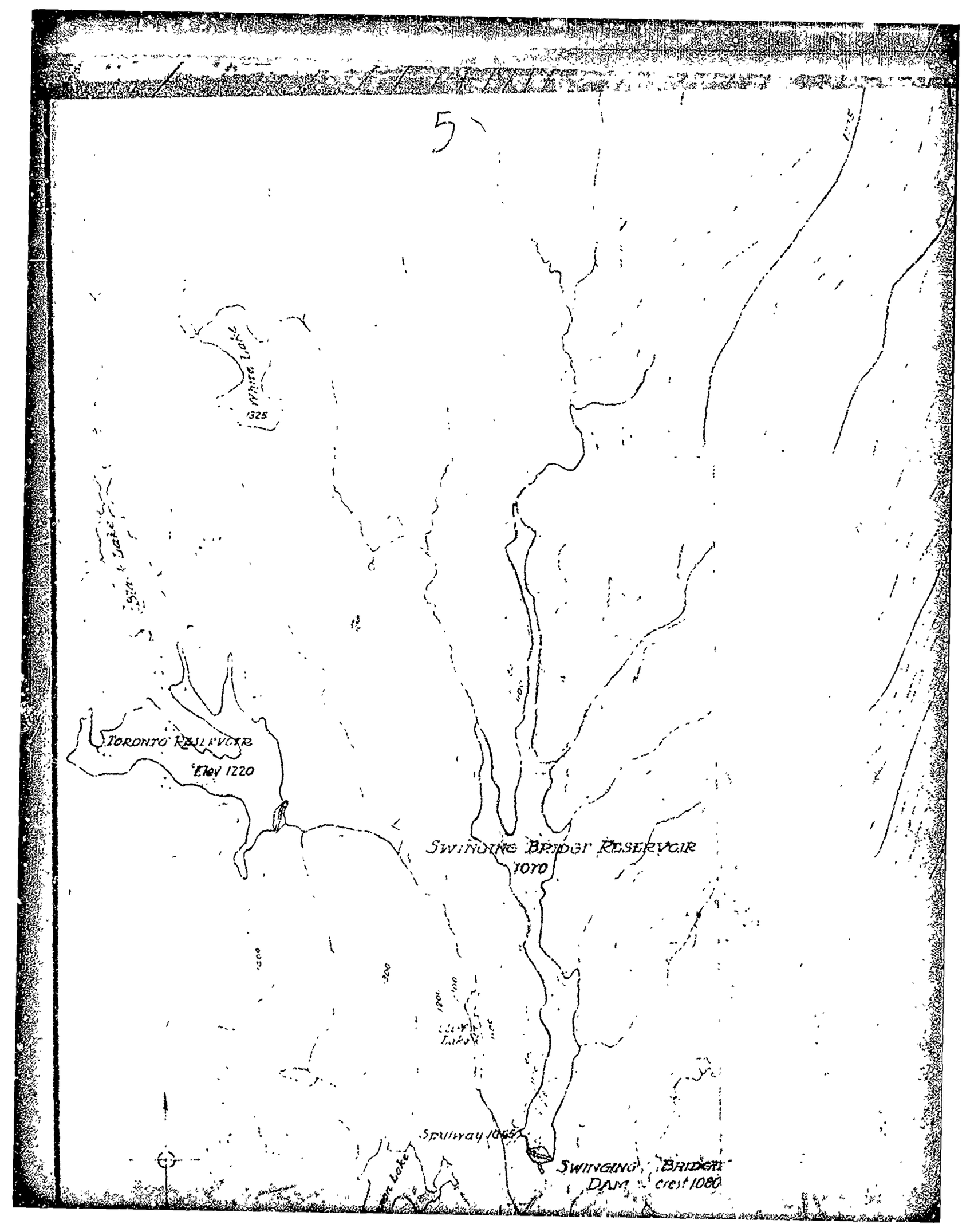


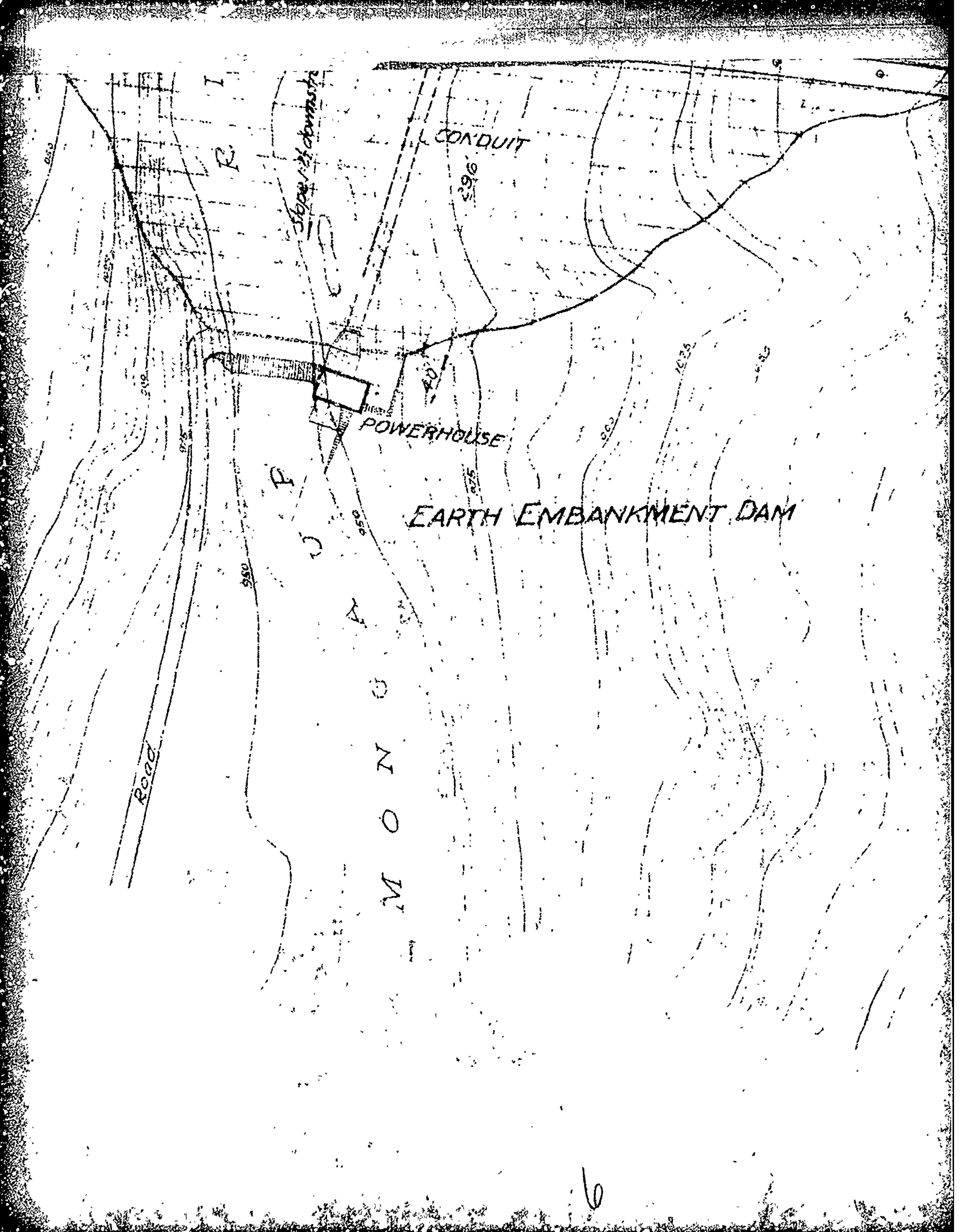
Slope .01
SPILLWAY CHANNEL
500' R
270'
14°
30°
65'
2WF
1WF
230'
14+28.9
0+00
90°
50'
100'
125'


2
INTAKE
GATE TOWER
Slope 1:1 upstream
Sta 4+90
246
78°
24
150
692

Elev. 1070
Water Line
Reservoir Fun
60+00

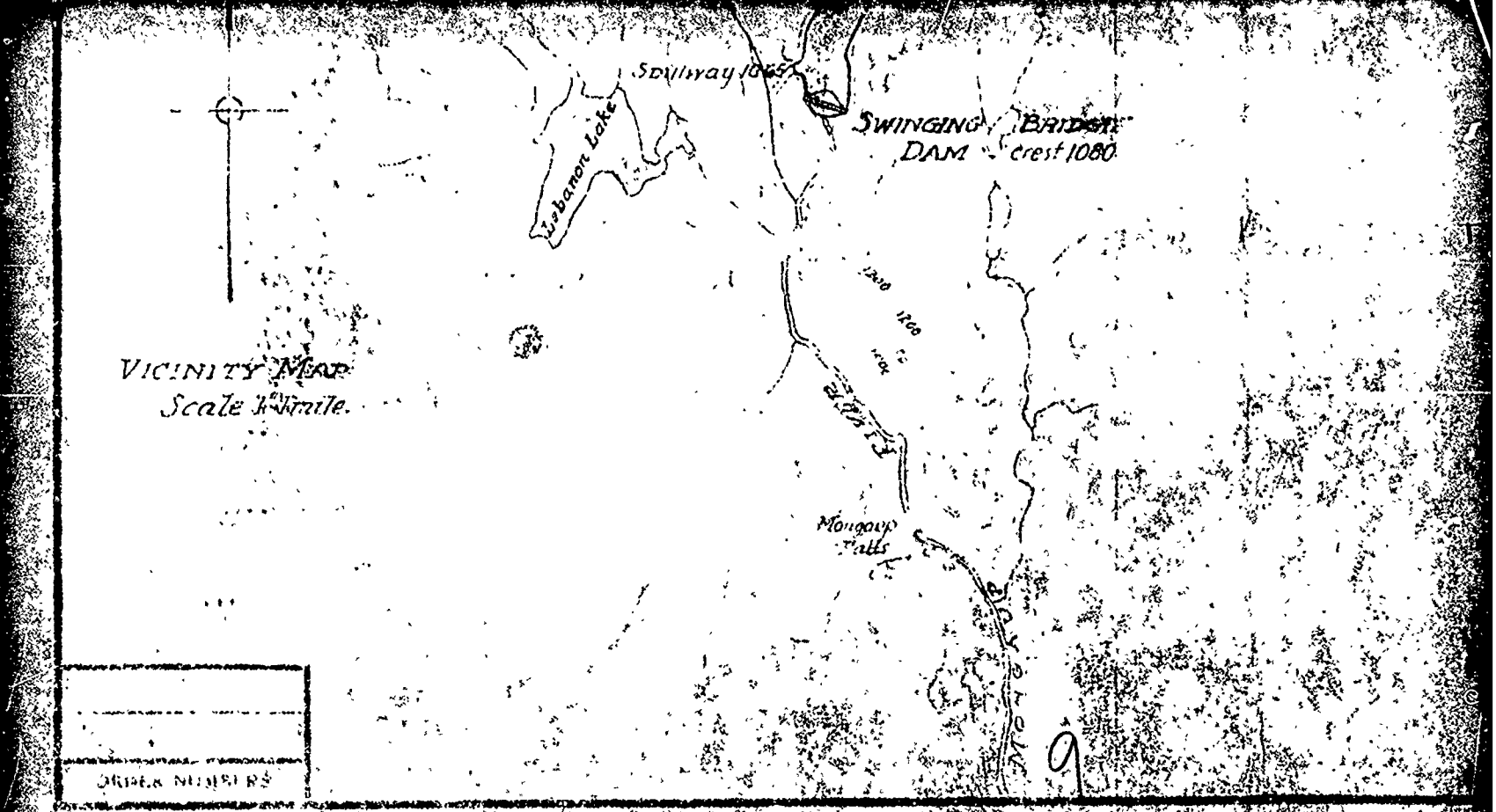



5
White Lake
1325
Stn Lake
TORONTO RESERVOIR
Elev 1220
SWINGING BRIDGE RESERVOIR
1070
Spillway 1065
SWINGING BRIDGE
DAM crest 1080


CONDUIT
POWERHOUSE
EARTH EMBANKMENT DAM
Road


AXIS OF DAM
1100
1125
1150
1175
1200
1225

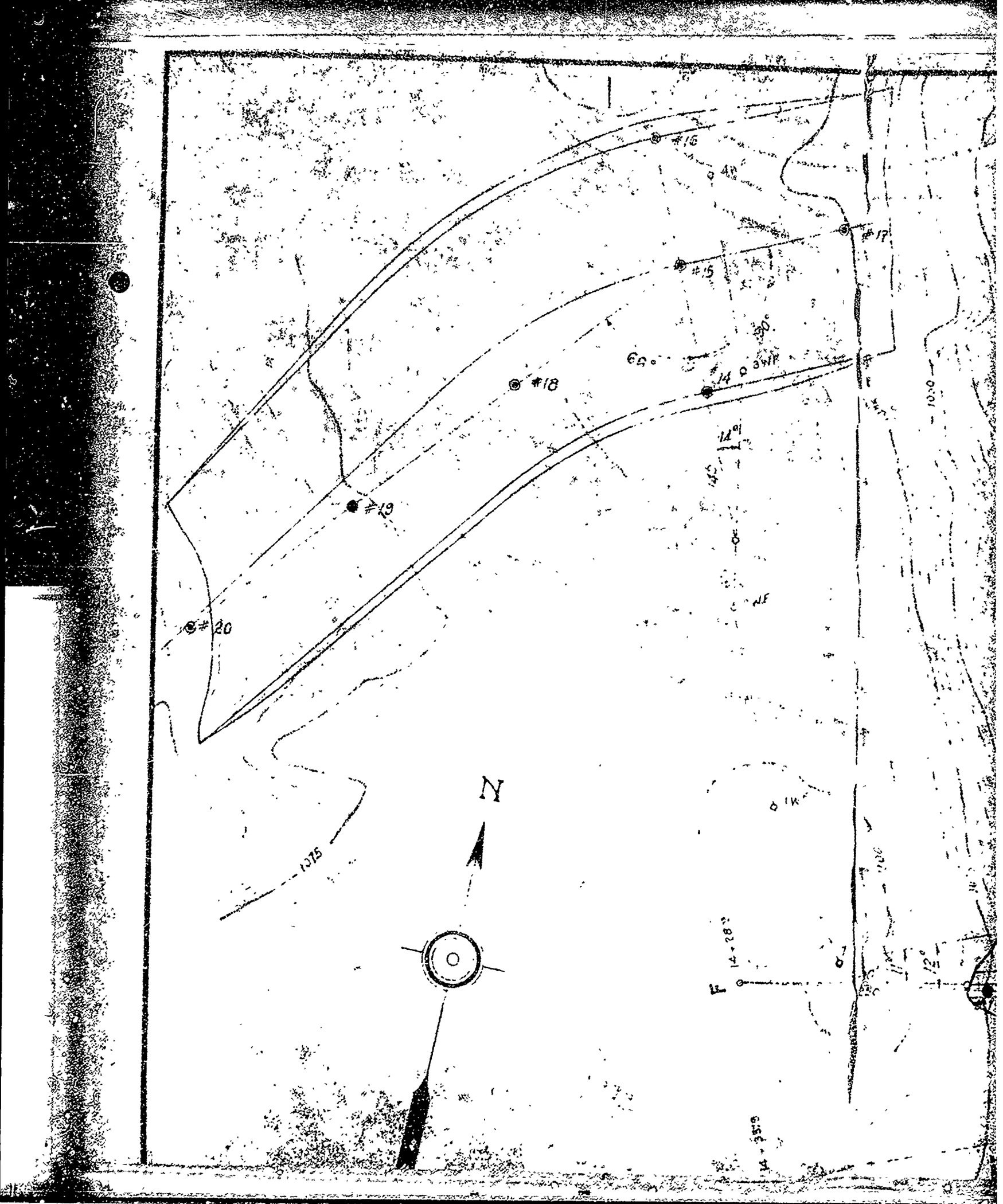
1225
1250
1275
8



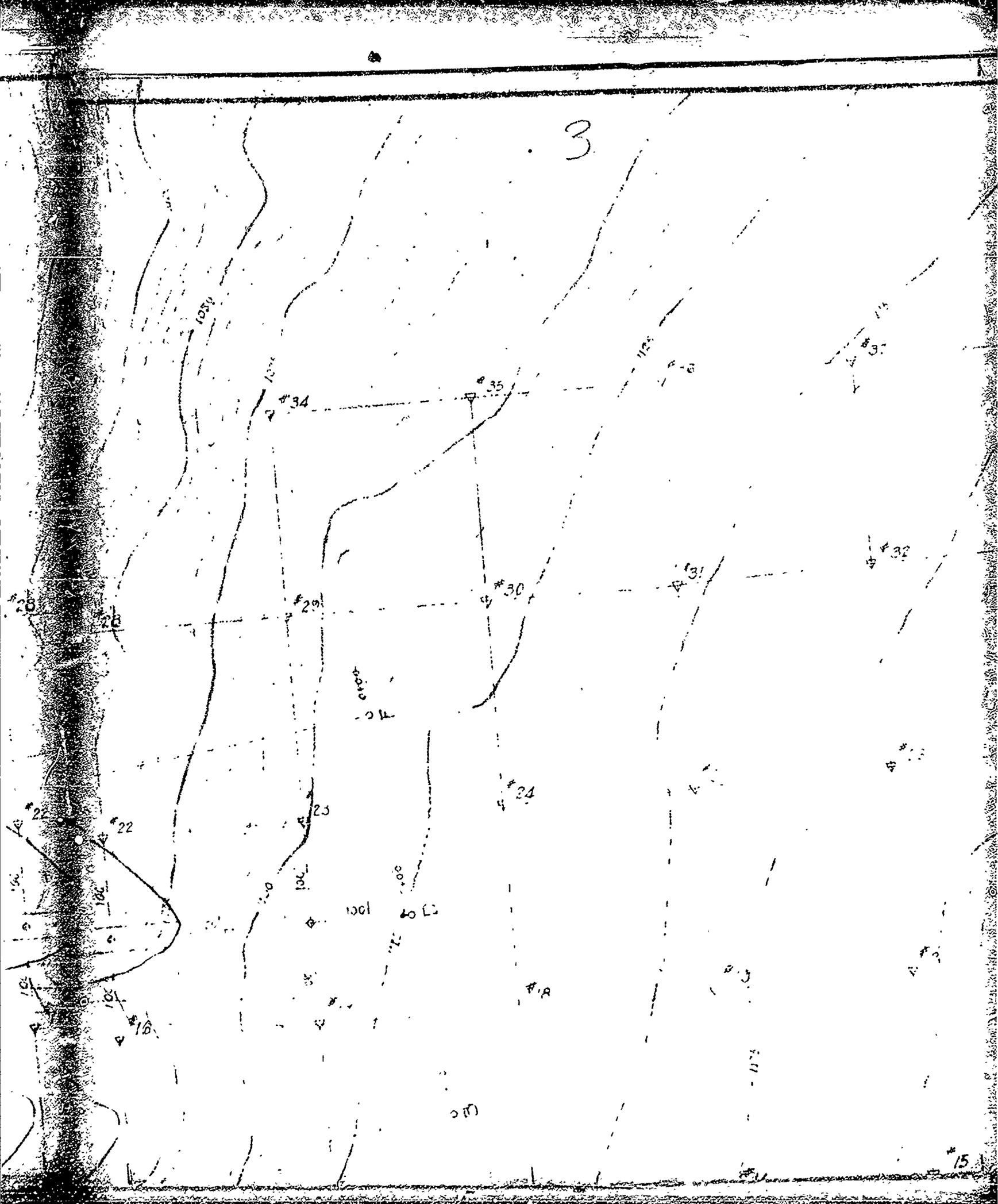
VICINITY MAP
Scale 1 inch = 1 mile.

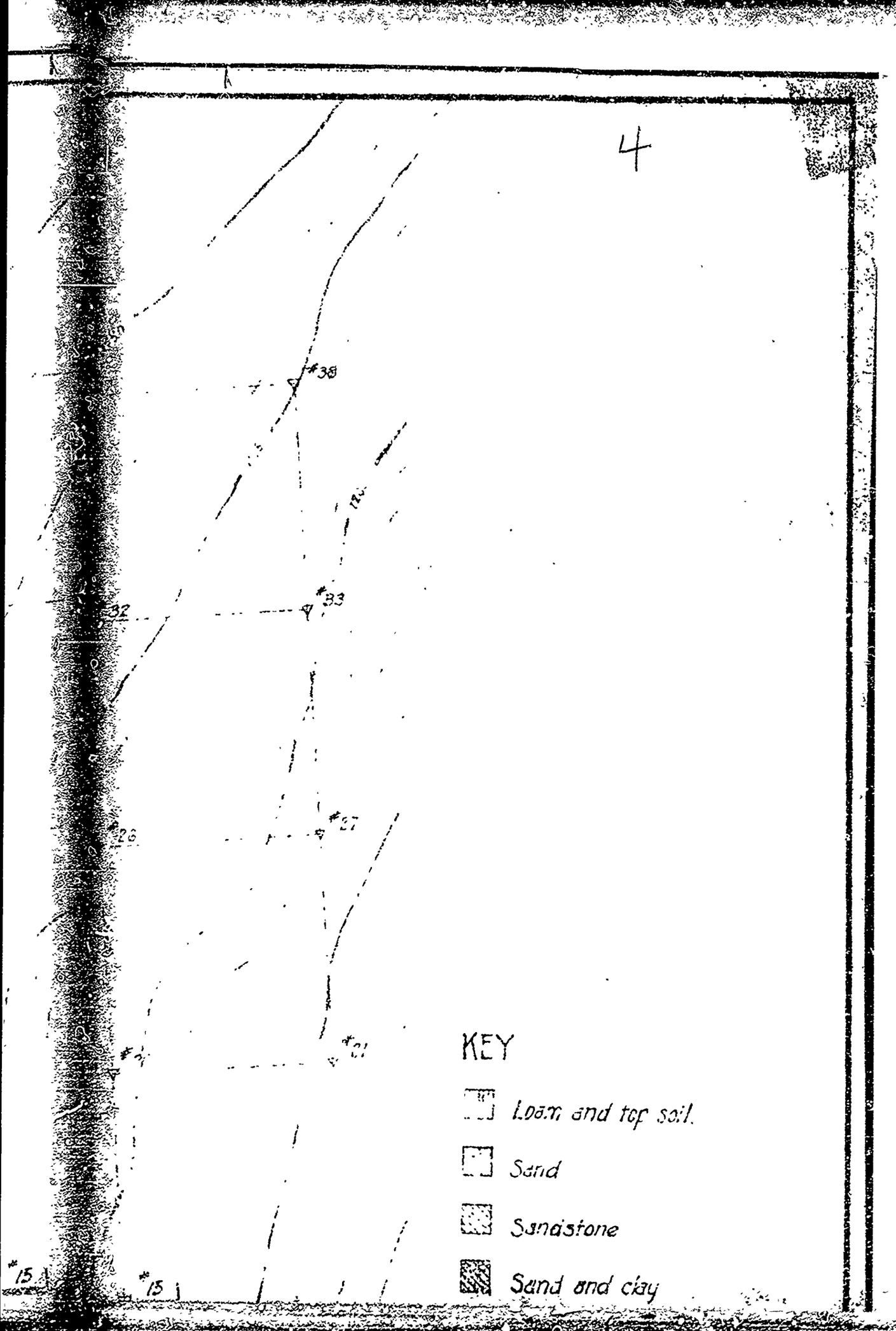
REFERENCE DRAWINGS

NUMBER	TITLE
KK-3-16	BORINGS
17	DAM
18	SPILLWAY
19	INTAKE
21	GATE TOWER
25	CONDUIT
28	OUTLET WORKS

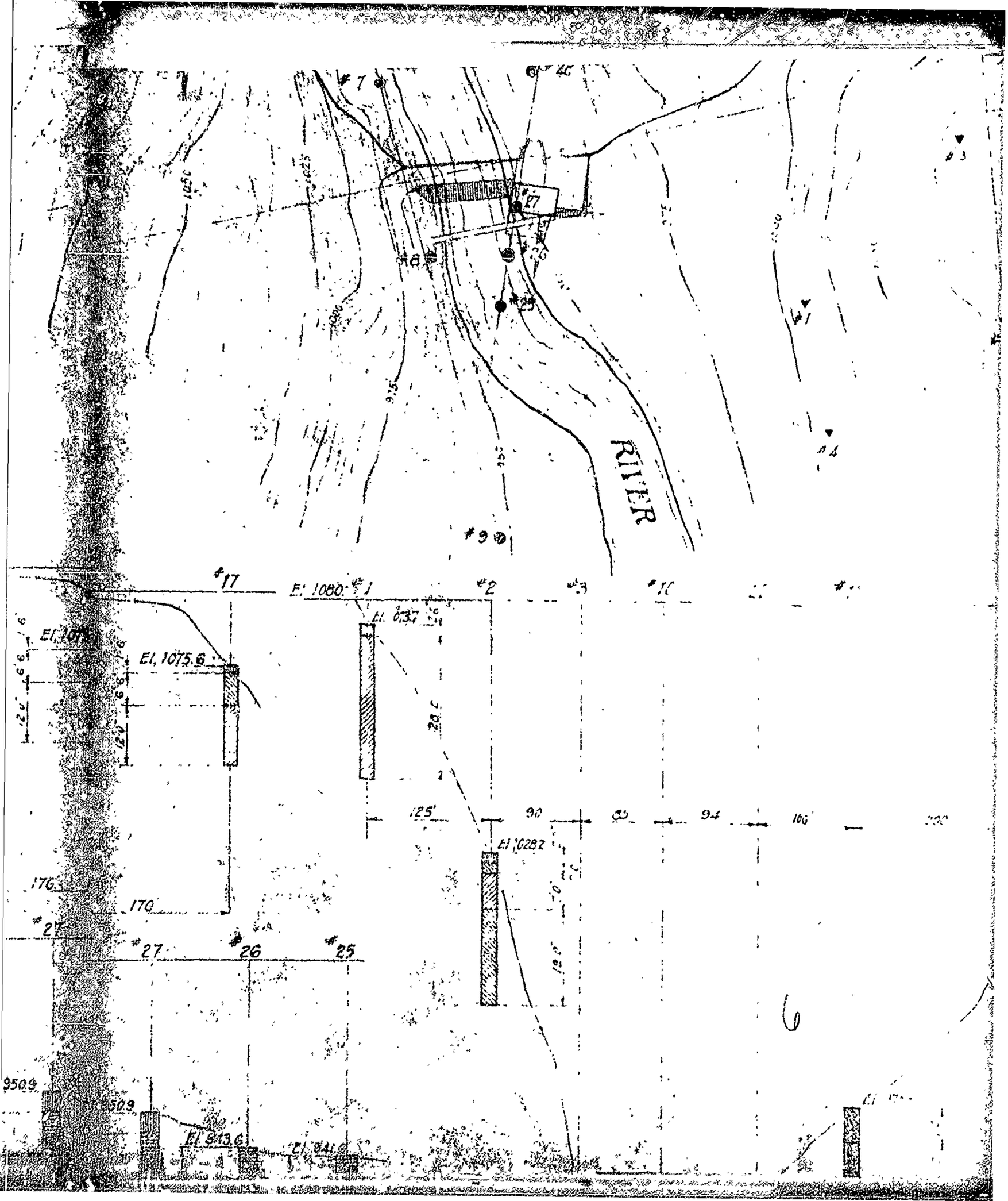

#16
#17
#15
#18
#19
#20
N
1375
1000


2
6
5
31
33
30
23
29
2
10
22
11
TONAWANDA

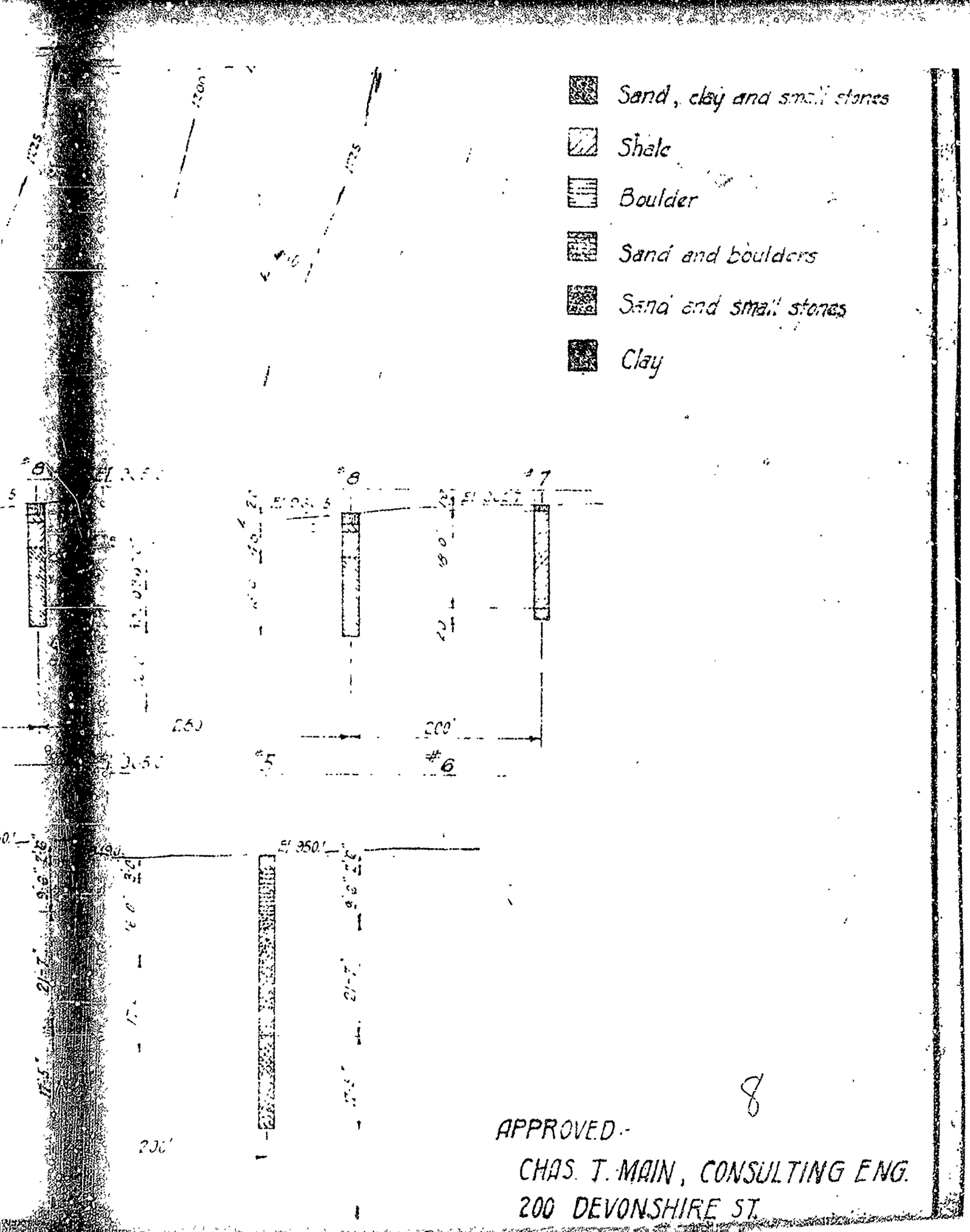

3
#34
#35
#30
#29
#28
#22
#16
#15


#38
#33
#32
#27
#26
#21
#15
#15
KEY
Loam and top soil
Sand
Sandstone
Sand and clay


5
#16
#15
#14
#19
#18
#32
#31
#30
#29
#28
El. 1100
El. 1090.1
El. 1030
El. 1057.6
El. 1002.1
El. 107.0
El. 988.6
El. 978.1
El. 975.3
El. 974.3
El. 953.4
El. 951.8
El. 950.9
200'
200'
200'
176'


RIVER
#17
El. 1080
#1
#2
El. 1075.6
El. 1028.2
125'
90
170'
#27
#26
#25
El. 913.6

Boring
Proposed Test Pit
Completed Test Pit
#23
El. 350.0
El. 349.0
El. 350.1
250'
230'
41'-0"
2½"Ø
9'-0"

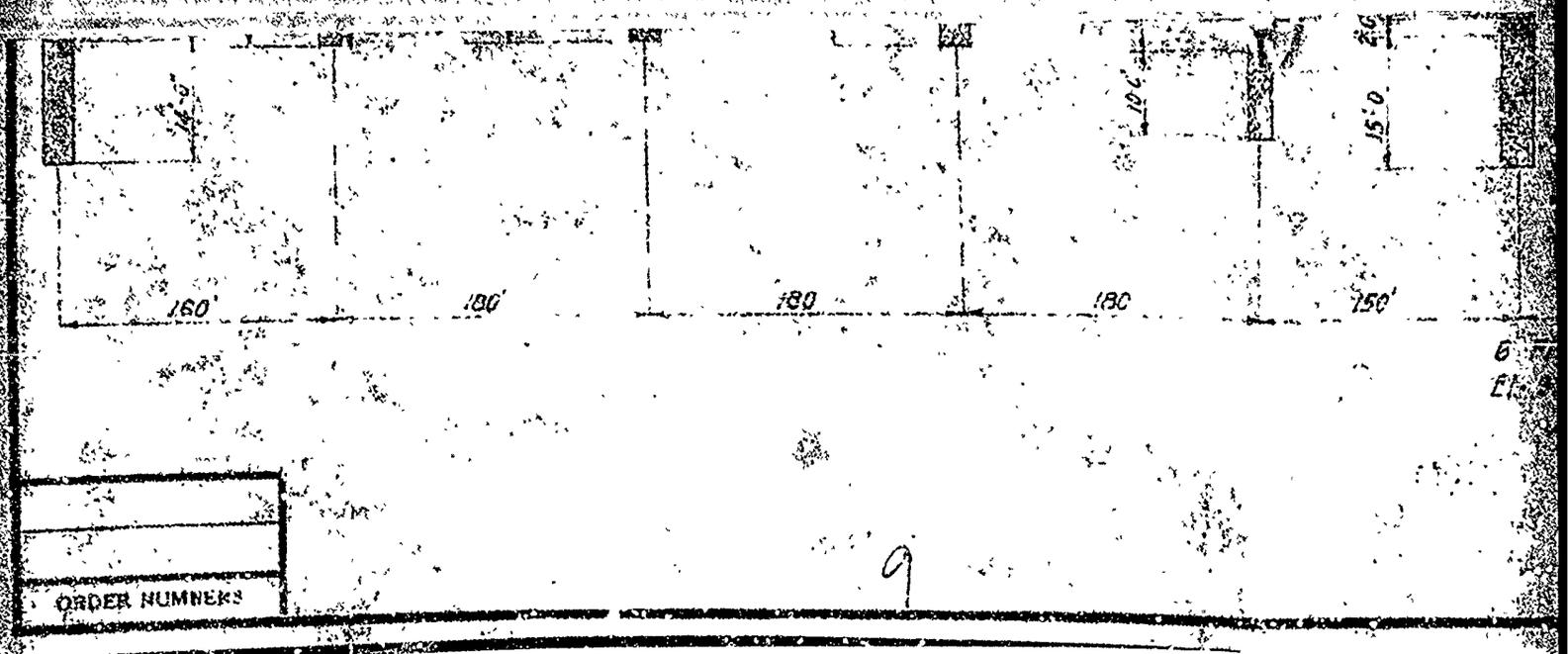


8

APPROVED:-

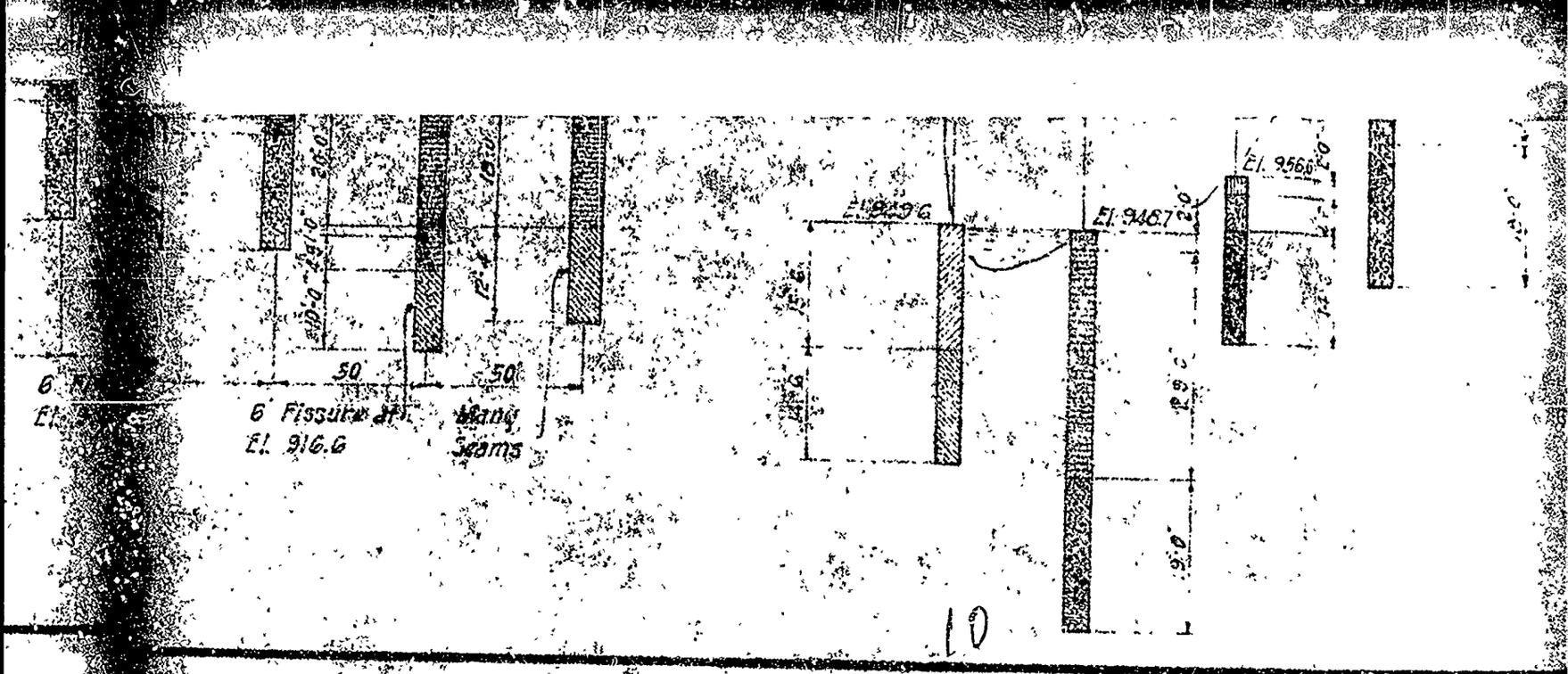
CHAS. T. MAIN, CONSULTING ENG.

200 DEVONSHIRE ST.



ORDER NUMBERS

9


El. 956.6
El. 946.7
El. 919.6
50
50
6' Fissure at El. 916.6
Sand Seams
10

CA

REV

THIS DRAWING IS THE PROPERTY OF CHARLES H. TENNEY & CO.
AND IS SUBJECT TO RETURN ON DEMAND.

BOSTON, MASS.

12 BY Chas T. Main

CATSKILL POWER CORP. MIDDLETOWN, N.Y.

REVISIONS		SWINGING BRIDGE DEVELOPMENT BORINGS	Drawn	Traced	Checked
			J.O.F.	O.K.C.B.	

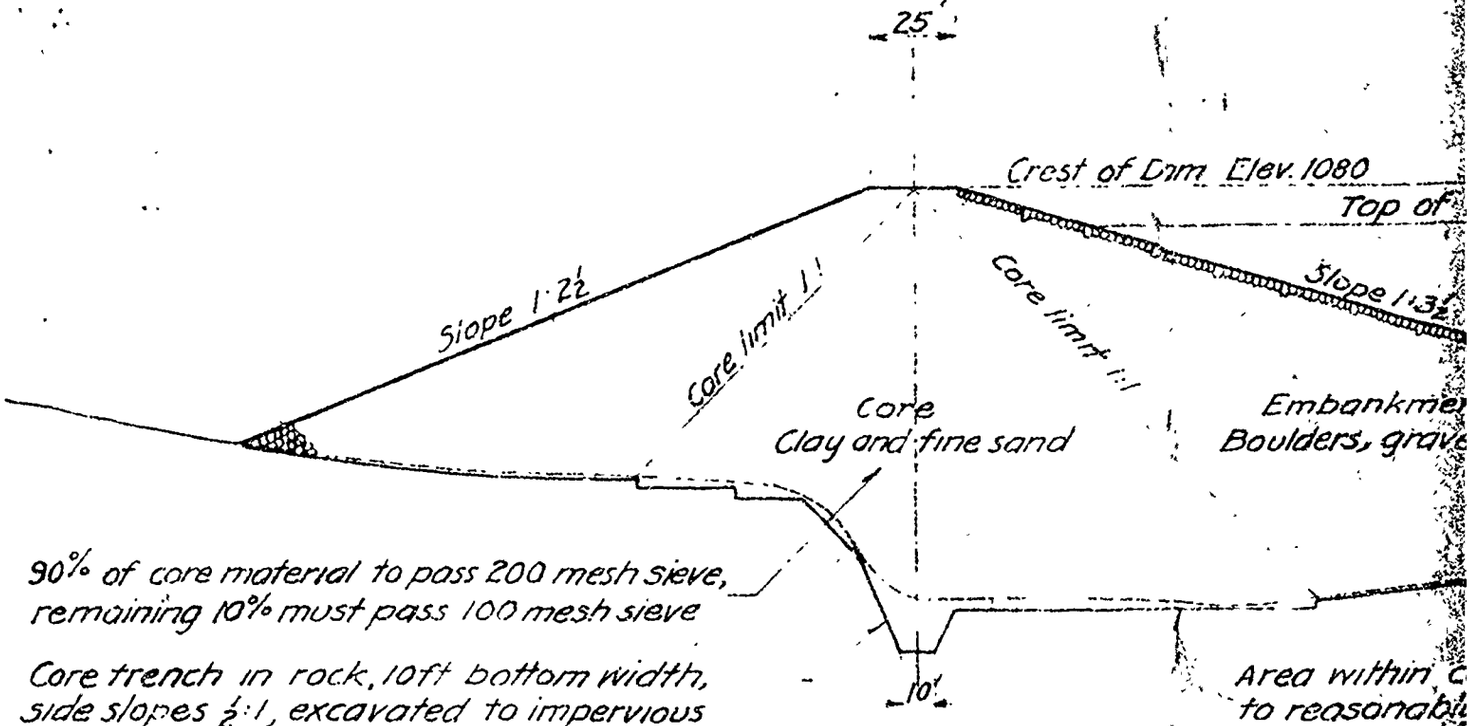
Examined: _____ Asst. Engineer

Approved: W. F. Tebbetts Engineer

PREPARED BY CHARLES H TENNEY & CO. ENGINEERS — BOSTON, MASS.

SCALES			
1" = 100'	1" = 20'	SEPT. 9, 1925	KK 3 16

25½ X 33½



90% of core material to pass 200 mesh sieve, remaining 10% must pass 100 mesh sieve

Core trench in rock, 10ft bottom width, side slopes ½:1, excavated to impervious material.

Area within c
to reasonabl

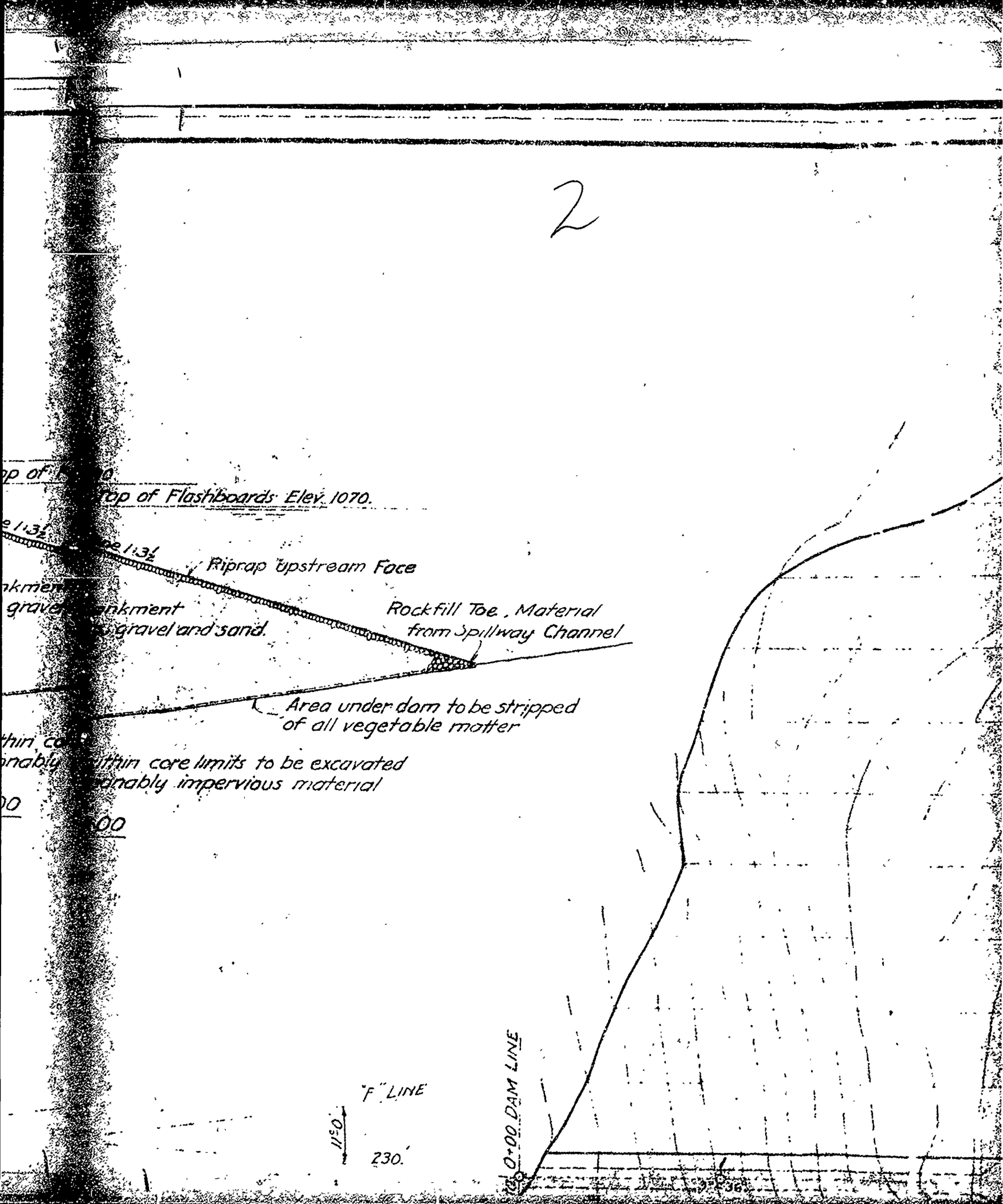
CROSS SECTION OF DAM AT STA 2+00

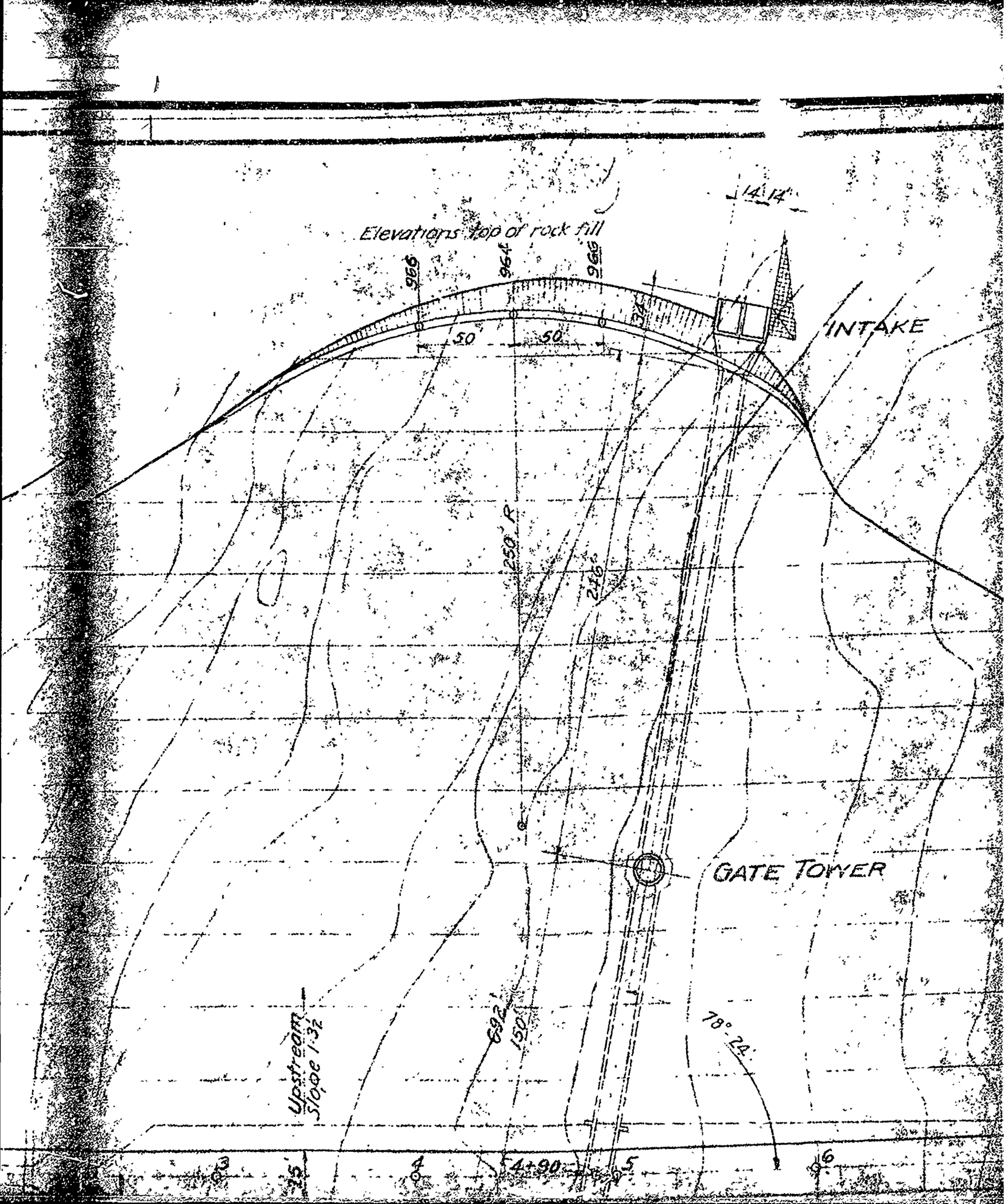
Scale 1" = 50'

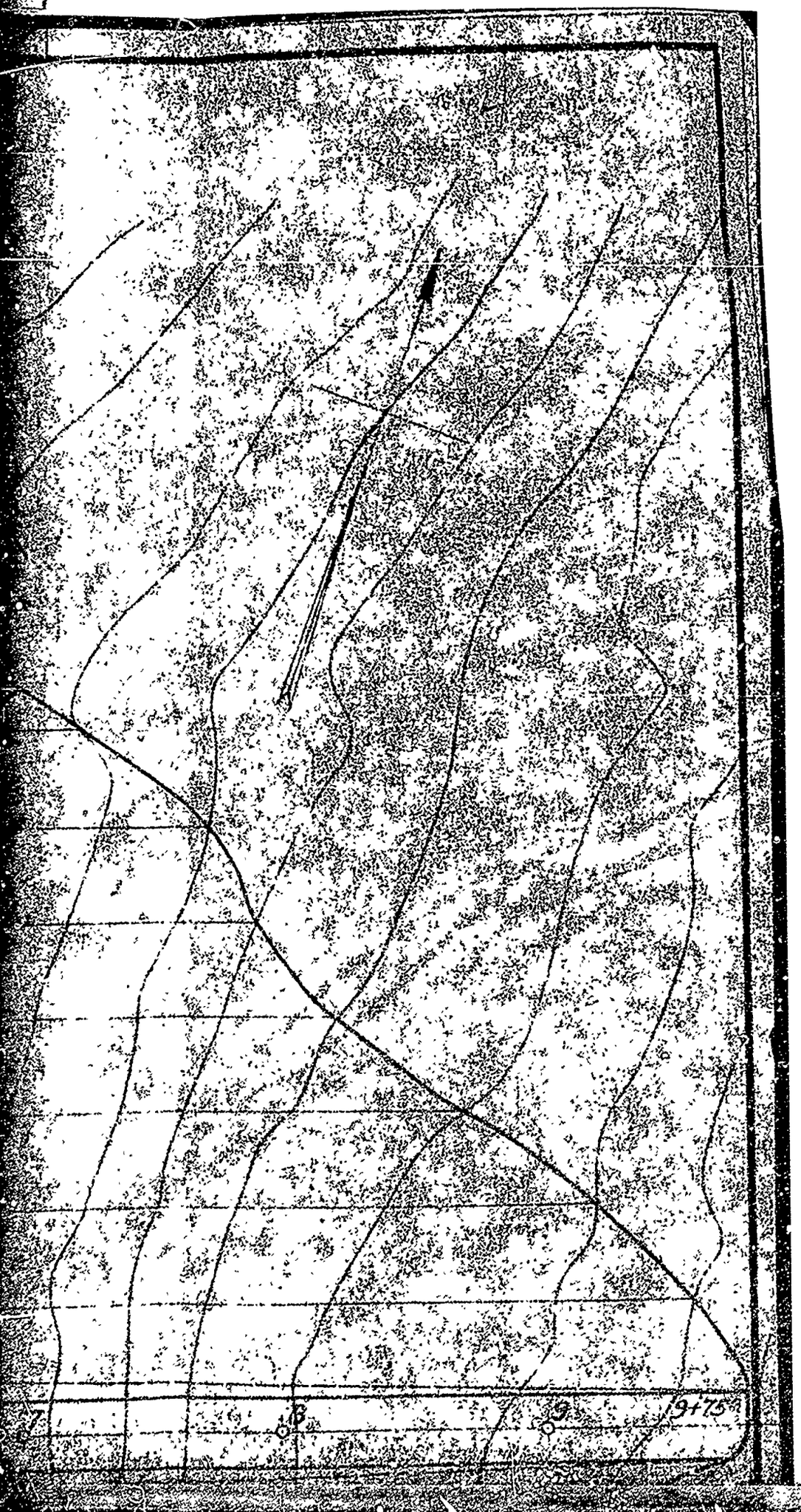
Note, This cross section is typical between Stations 0+00 and 2+40

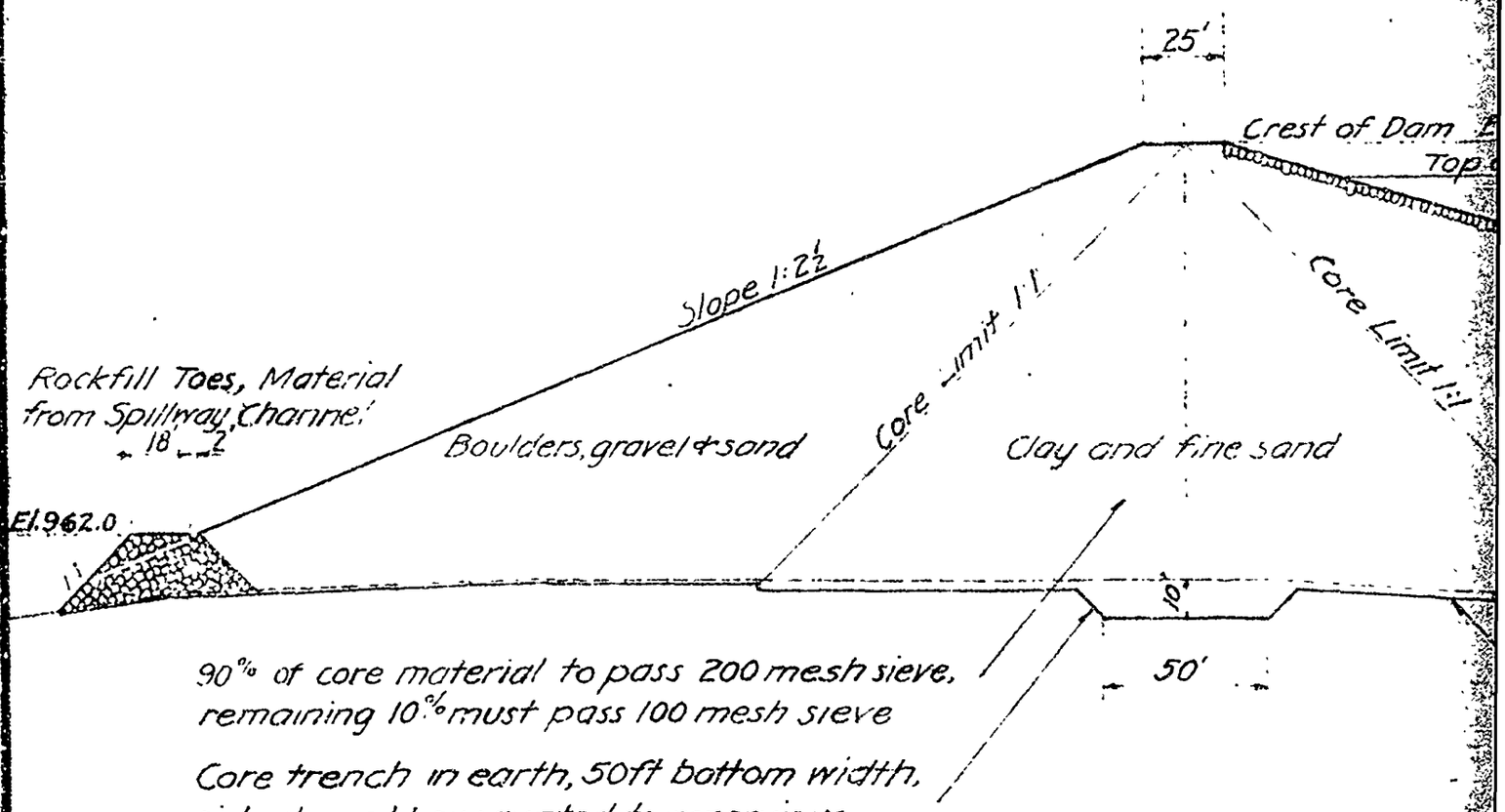
F. 0,442890.

2


op of
Top of Flashboards Elev. 1070.
e 1:3½
e 1:3½
Riprap upstream Face
nkmen
grave nkment
gravel and sand.
Rockfill Toe, Material
from Spillway Channel
Area under dam to be stripped
of all vegetable matter
thin co
onably thin core limits to be excavated
onably impervious material
00
00
"F" LINE
11°0'
230'
0+00 DAM LINE


Elevations top of rock fill
966
964
966
50
50
14'
14'
INTAKE
250' R
276'
GATE TOWER
Upstream
Slope 1:3½
692'
150'
78° 24'
3
4
5
6
4+90


7
8
9
9+75



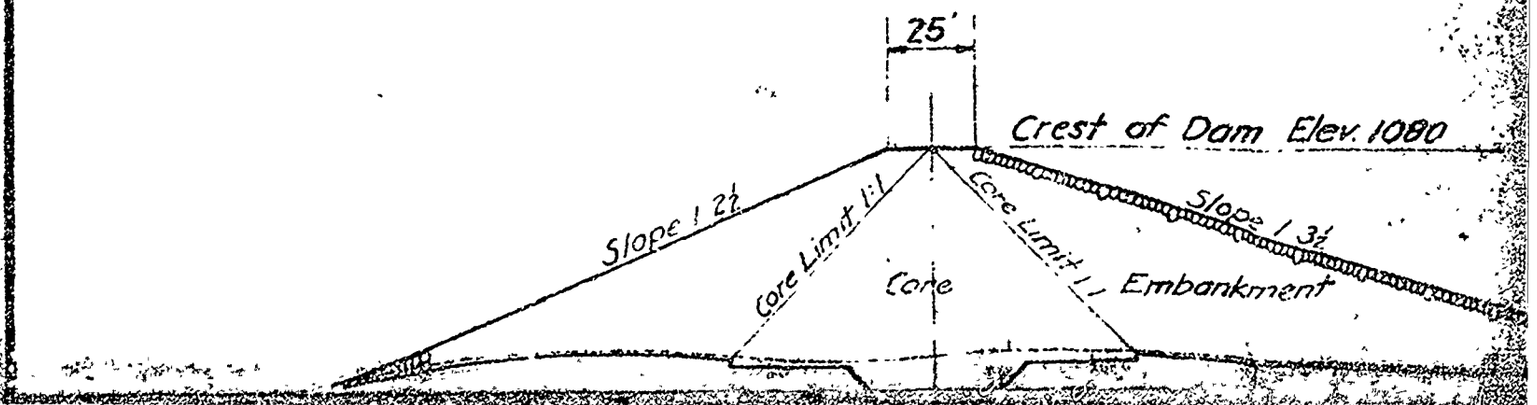
90% of core material to pass 200 mesh sieve, remaining 10% must pass 100 mesh sieve

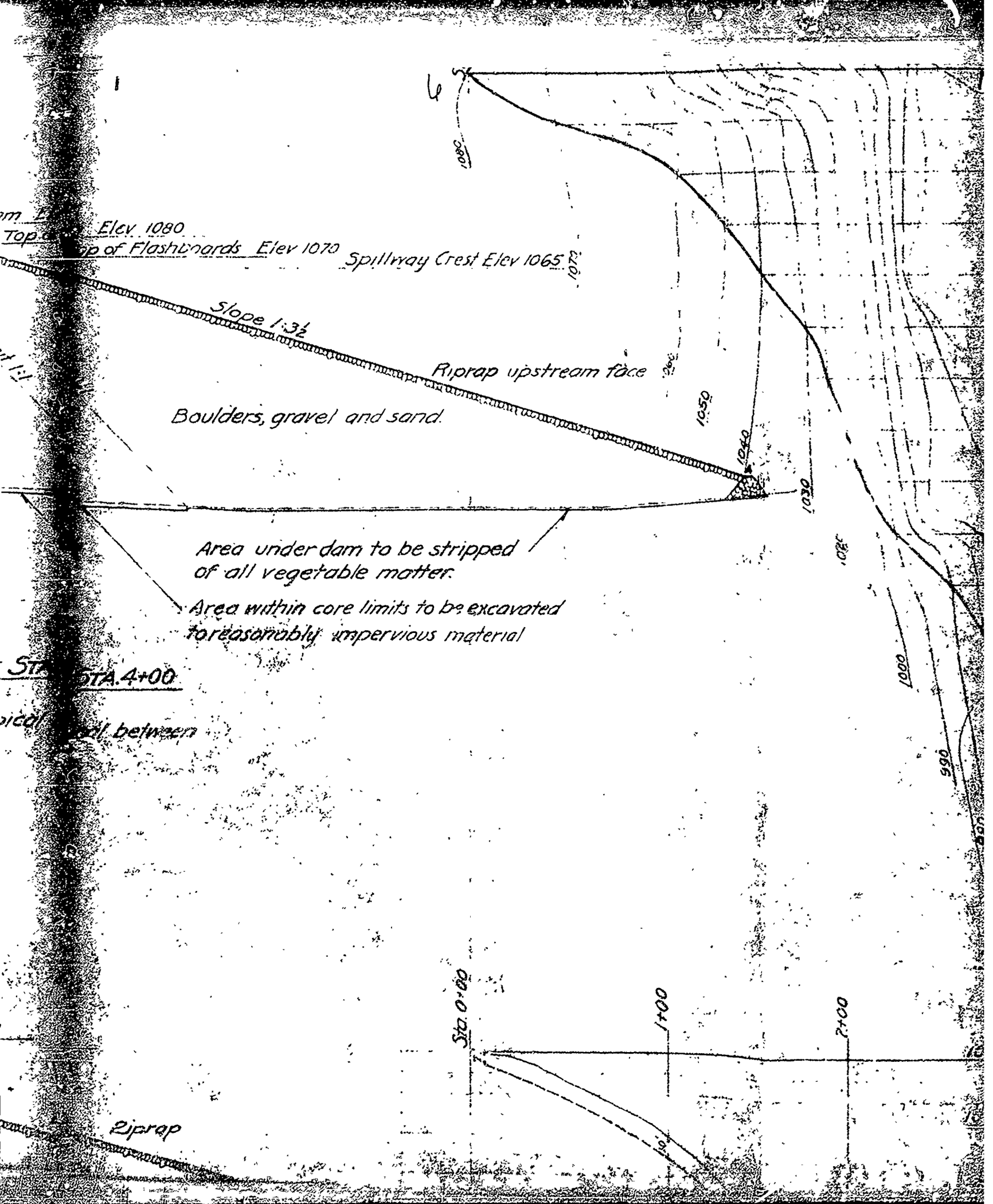
Core trench in earth, 50ft bottom width, side slopes 1:1, excavated to impervious material

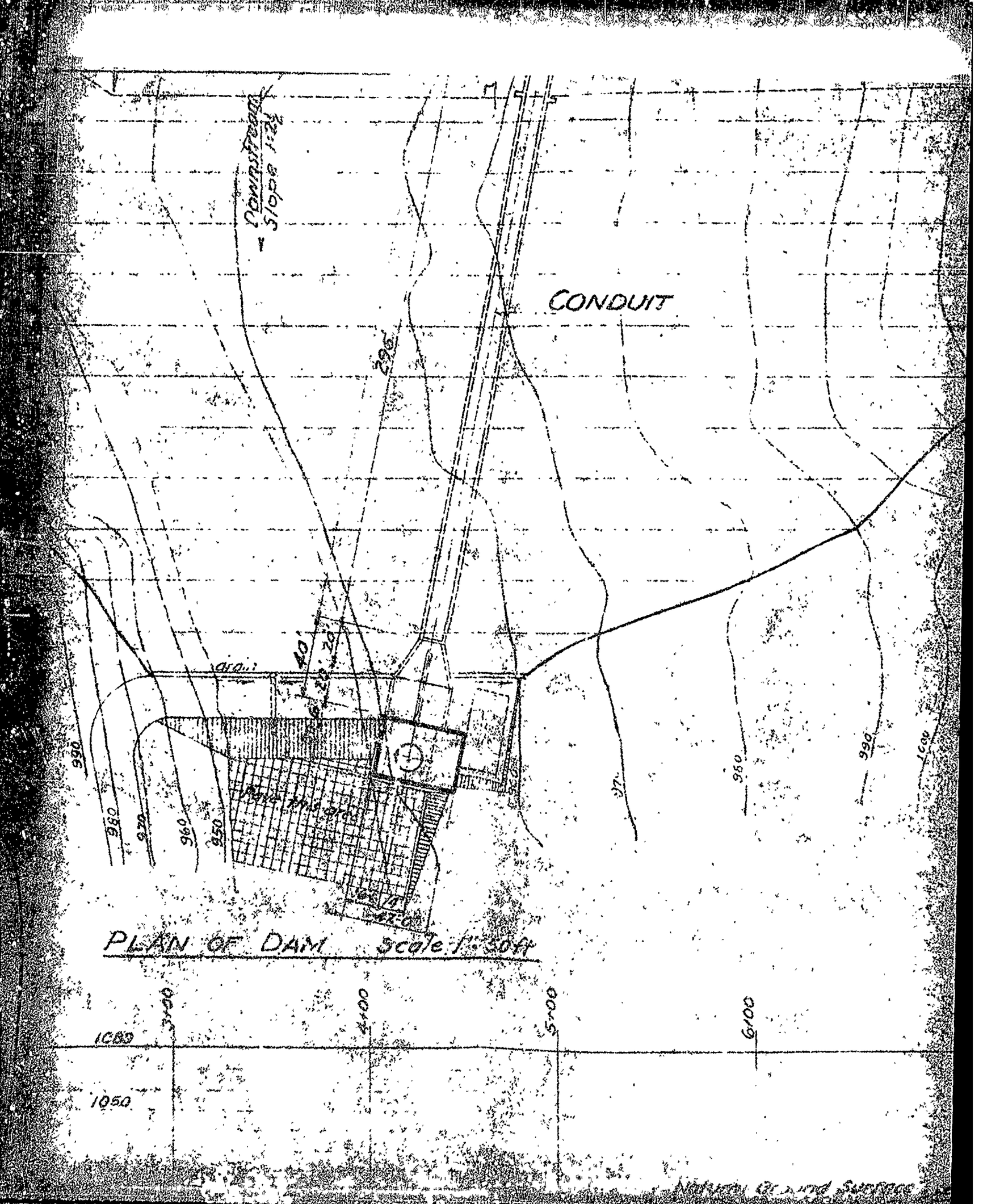
CROSS SECTION OF DAM AT ST

Scale 1" = 50'

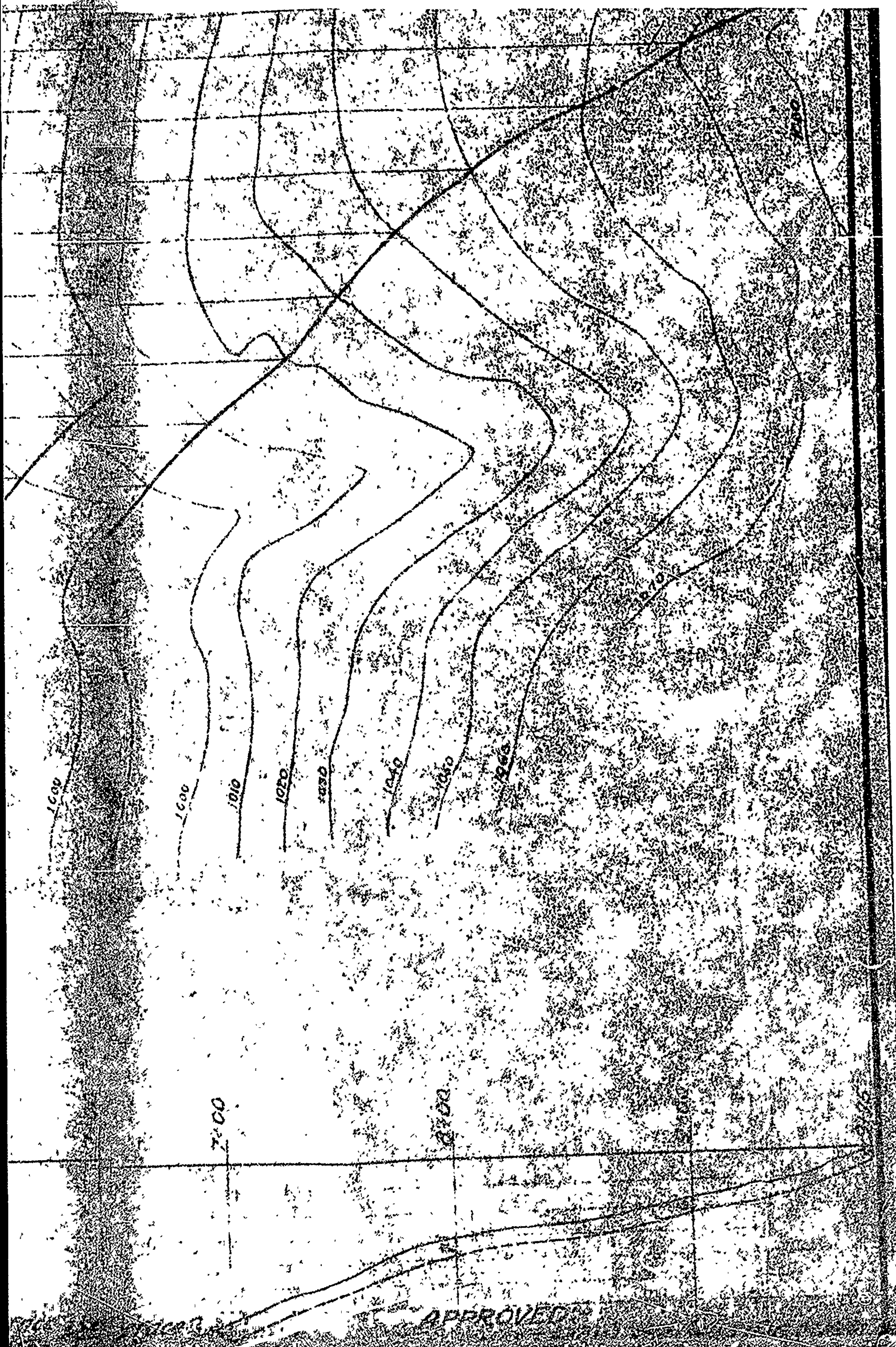
Note; This cross section is typical Stations 2+40 and 5+00



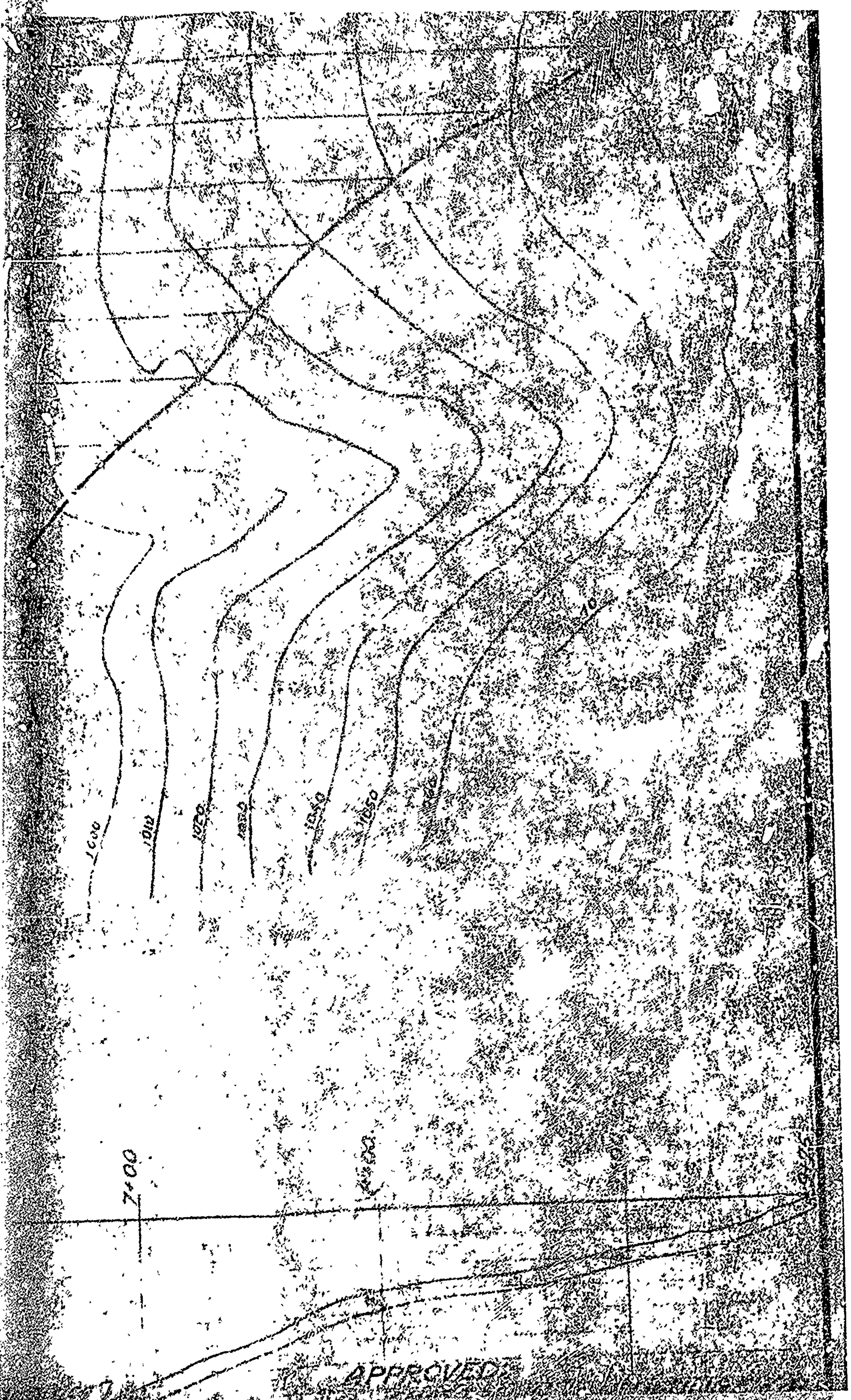

Elev 1080
Spillway Crest Elev 1065
Slope 1:3½
Riprap upstream face
Boulders, gravel and sand.
Area under dam to be stripped of all vegetable matter.
Area within core limits to be excavated to reasonably impervious material
STA. 4+00
Sta 0+60
1+00
2+00
Riprap
1080
1070
1050
1040
1030
1020
1000
990

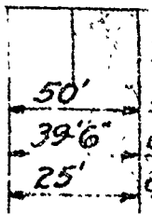


PLAN OF DAM Scale 1" 30ft



1000
1000
1010
1020
1030
1040
1050
7+00
8+00
APPROVED


1000
1010
1020
1050
7+00
APPROVED



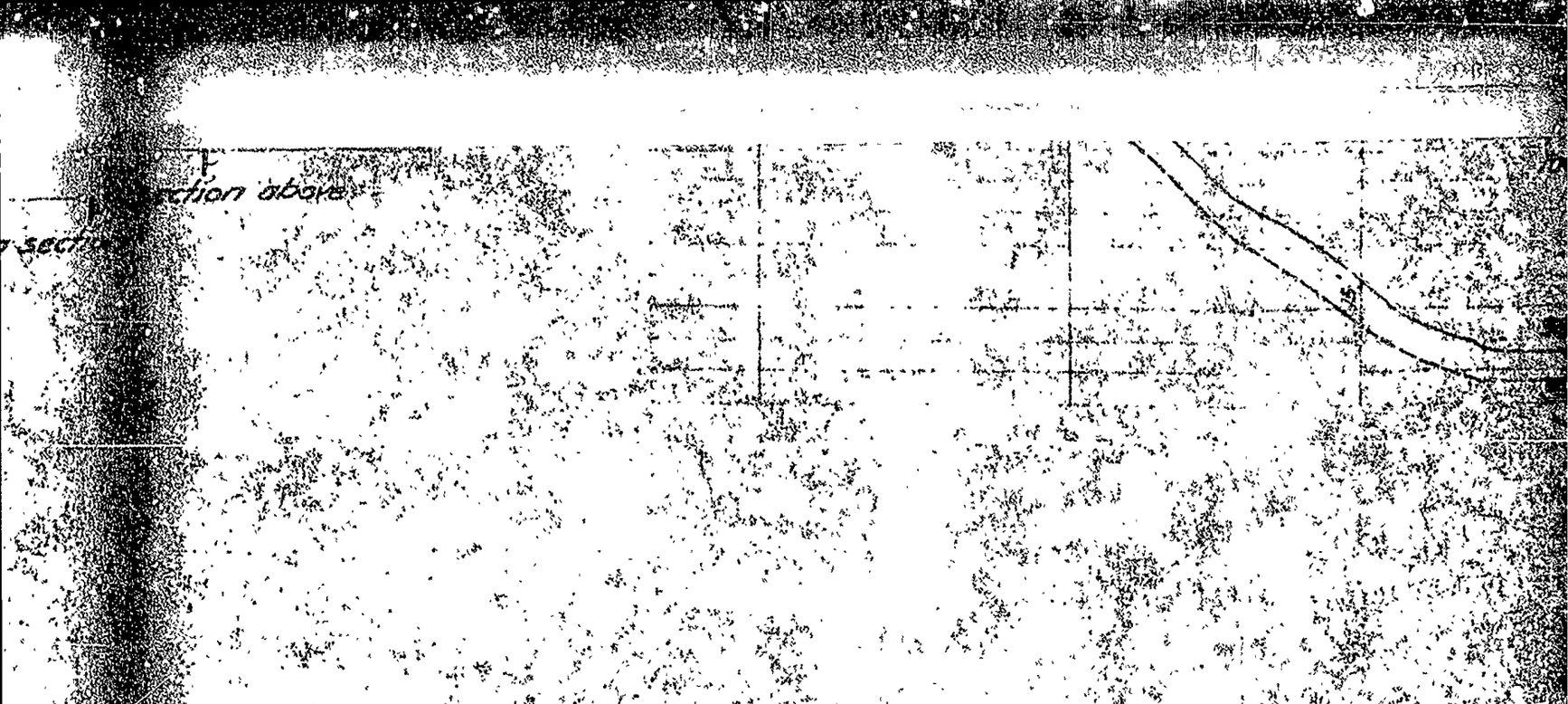
at Sta 5+00
at Sta. 7+00
at Sta. 9+75

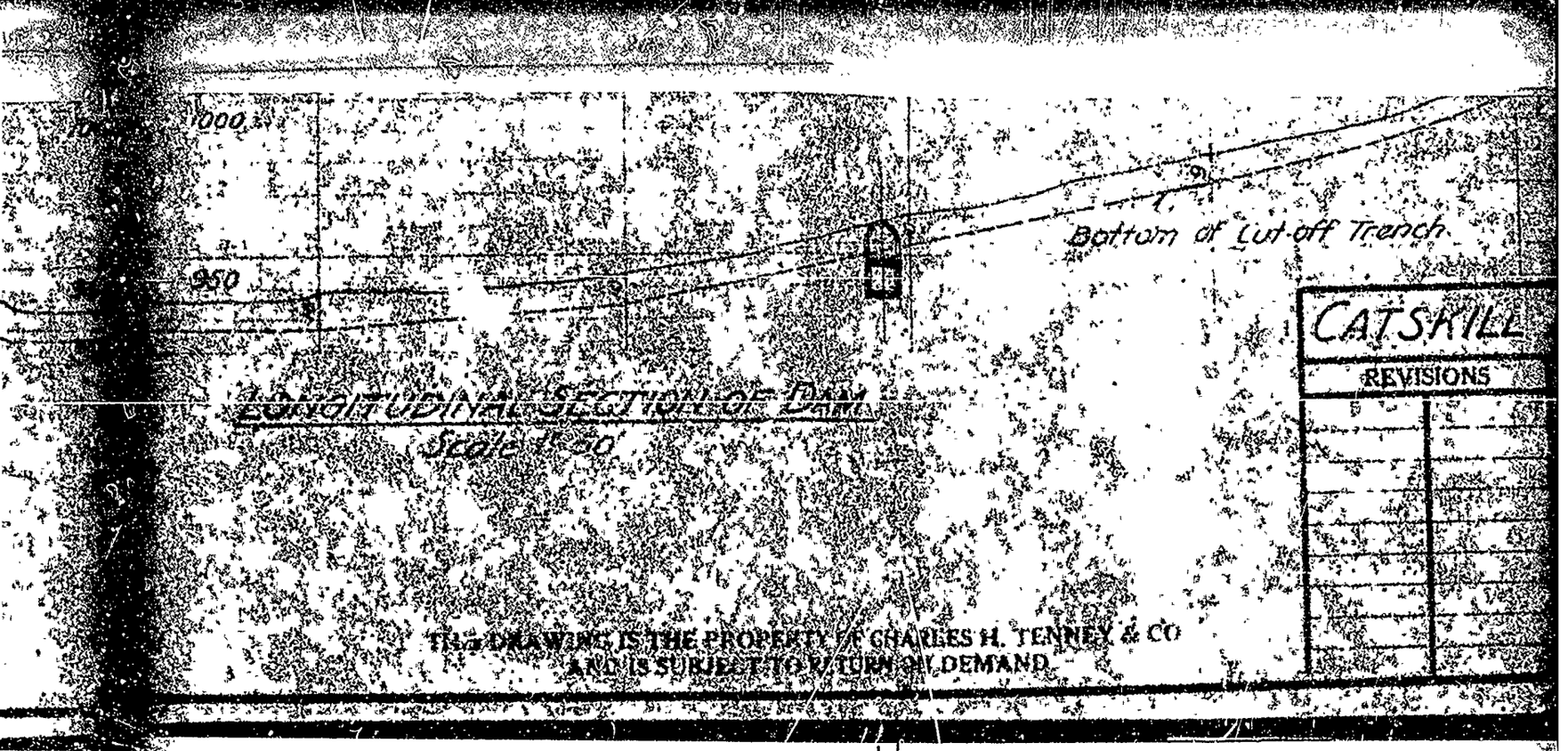
See notes on sect

CROSS SECTION OF DAM AT STA. 7+00

Scale 1" = 50'

Note; This cross section is typical between Stas. 5+00 and 9+75.


ction above
section
10

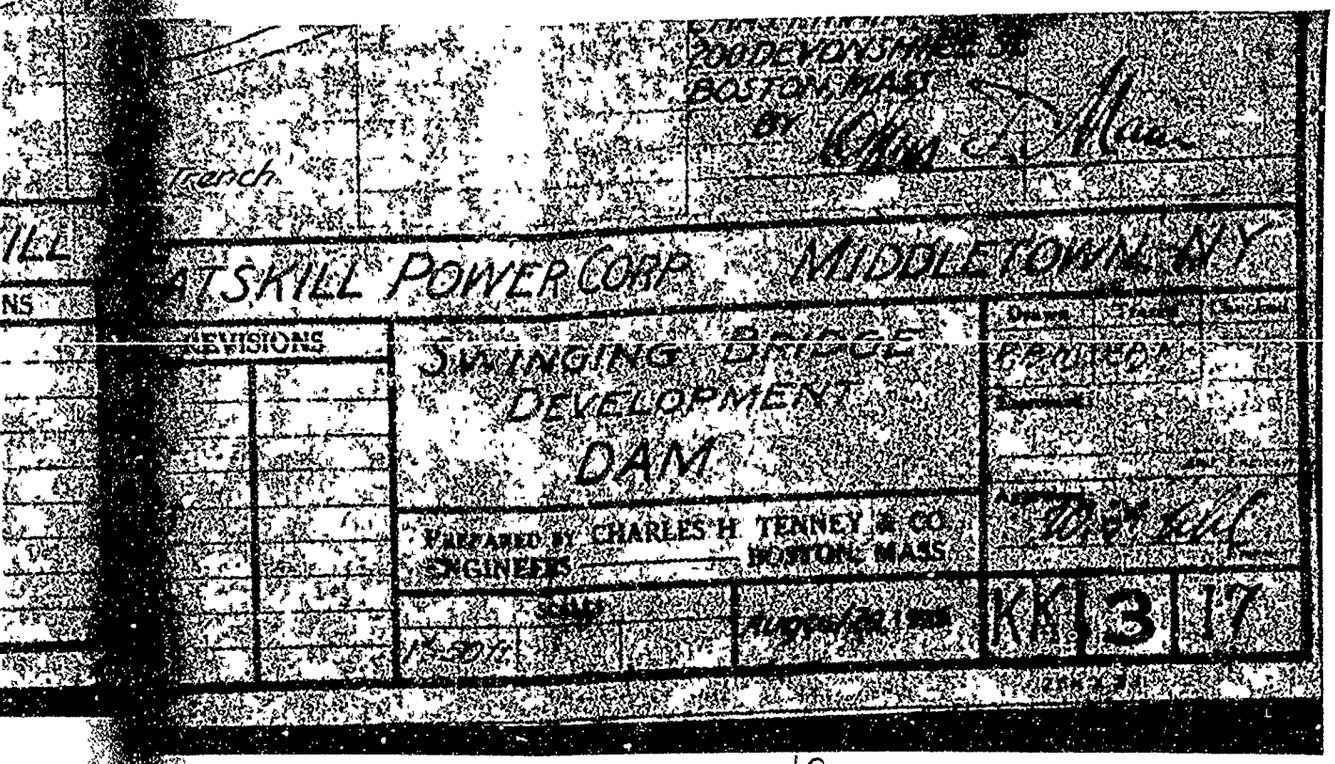


LONGITUDINAL SECTION OF DAM

Scale 1"=50'

CATSKILL

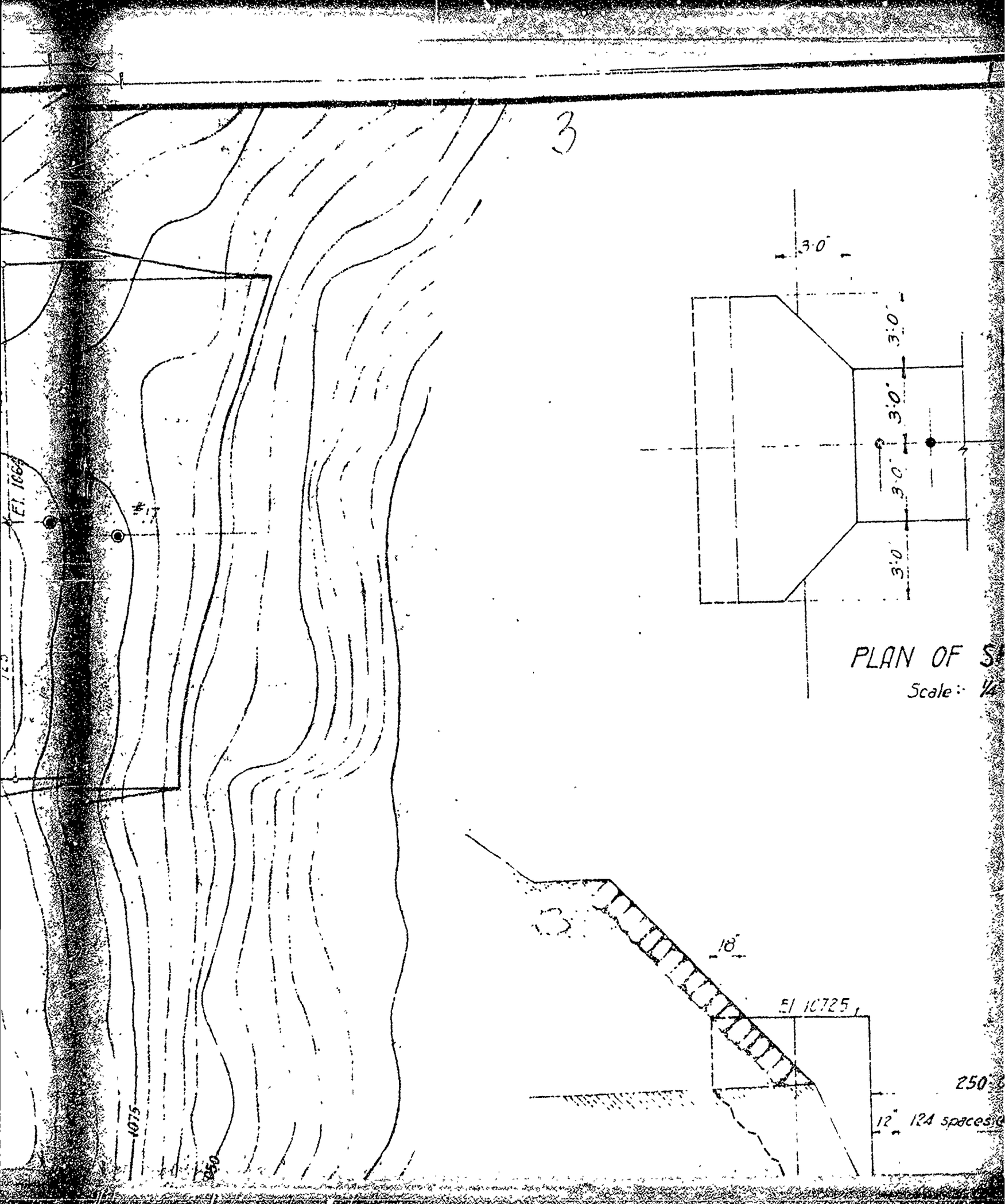
REVISIONS

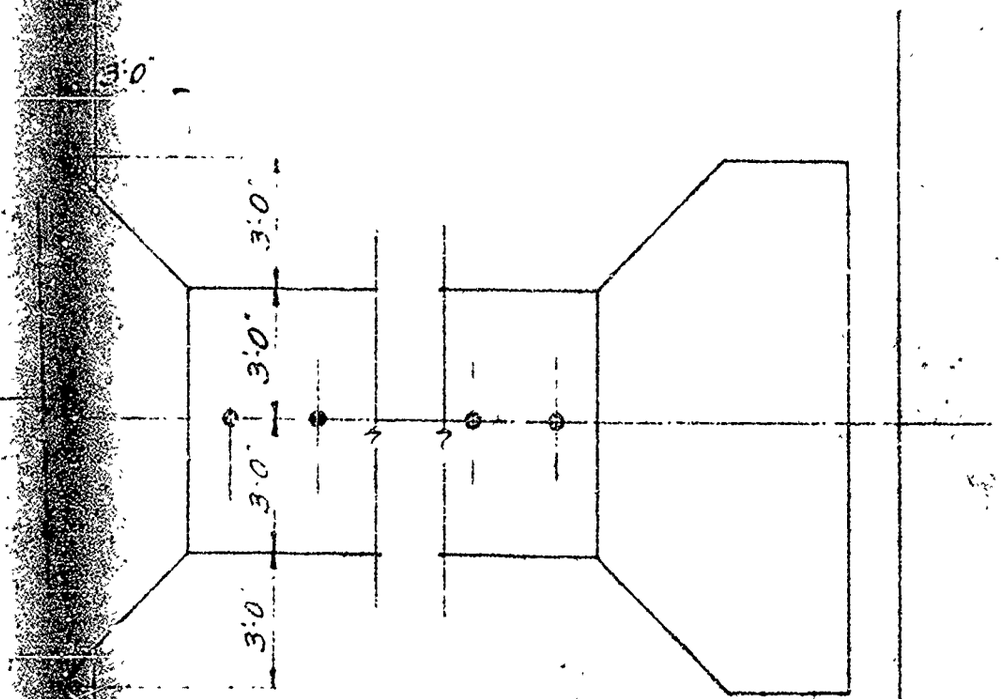

BOSTON, MASS
BY
MIDDLETOWN, N.Y.
REVISIONS
SWINGING BRIDGE
DEVELOPMENT
DAM
PREPARED BY CHARLES H. TENNEY & CO.
ENGINEERS
BOSTON, MASS.
PRINTED
KK
3
17

12

N
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5

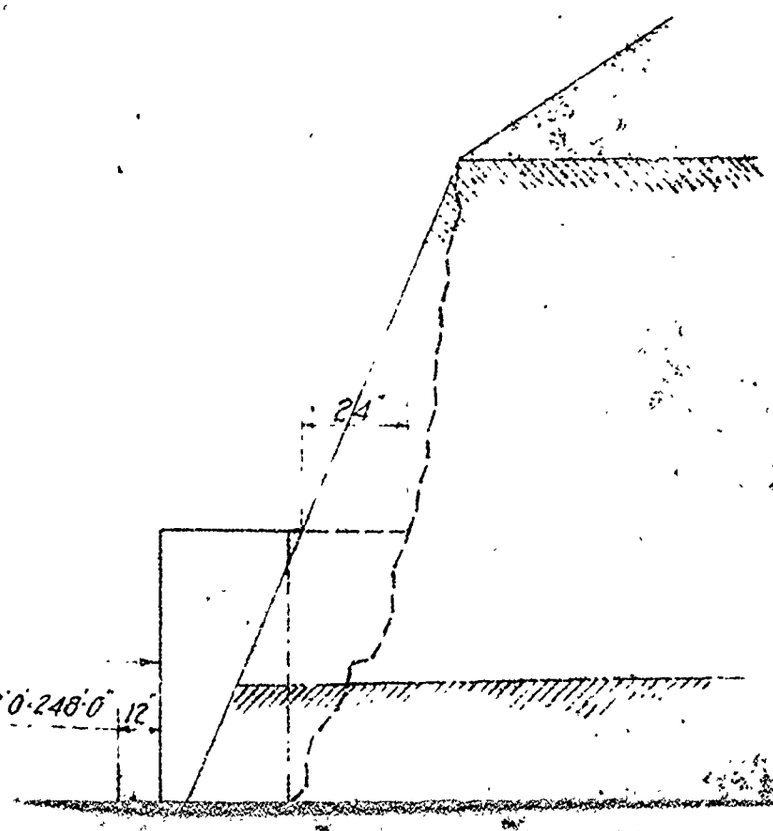
1100
A
16
4 WF
125'
125'
125'
125'
El. 1064
El. 1065
El. 1066
50'
50'
100'
100'
100'
100'
P.C.
B L
JB
#18
#14
3 WF
120'
120'
El. 1062
El. 1063
El. 1064
El. 1065
115'
115'
A
44°
R = 50'
65'

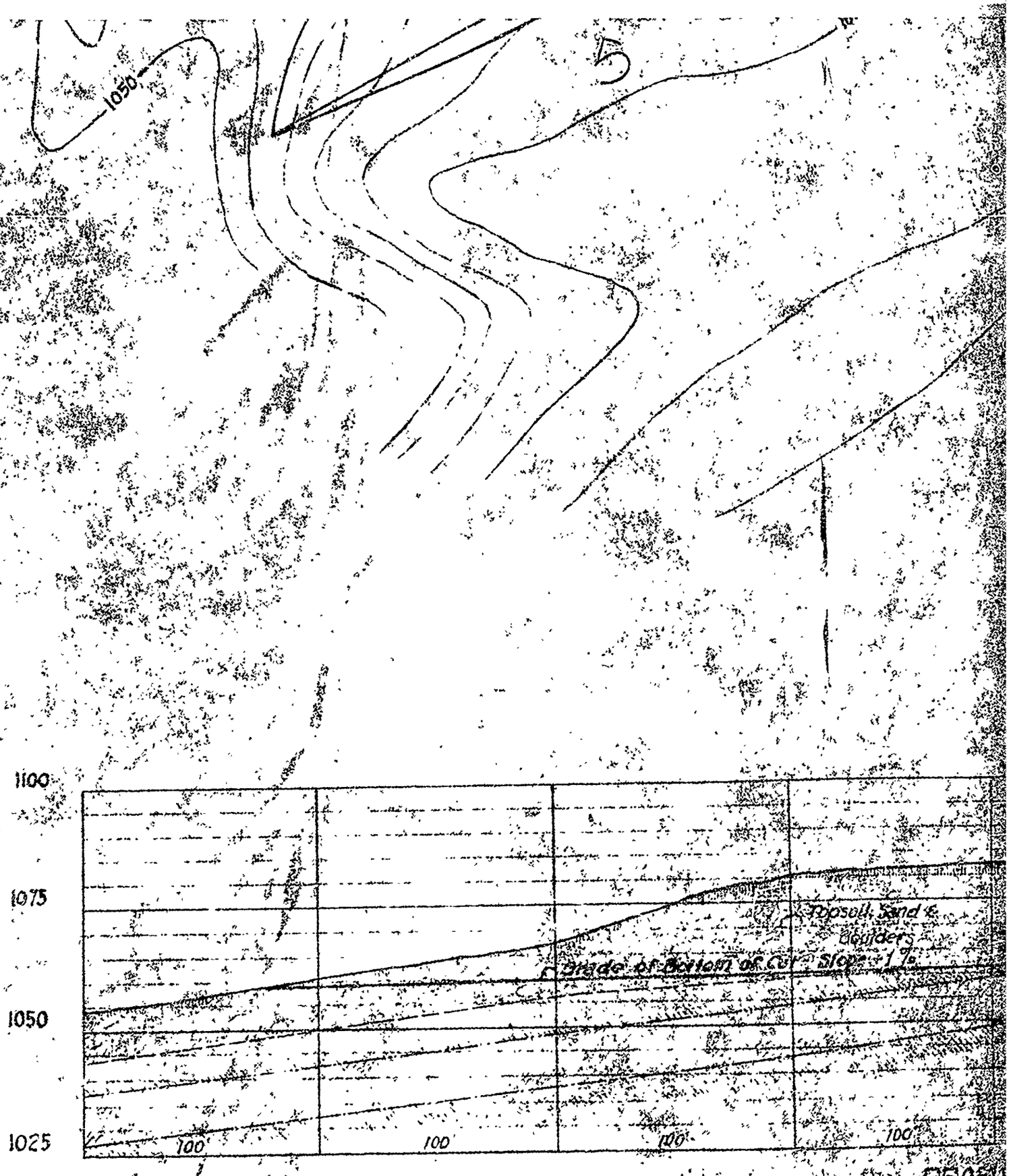

3
3·0'
3·0'
3·0'
3·0'
3·0'
PLAN OF S
Scale :- 1/4
El. 1065
1075
1050
18"
El 1072.5
250'
12" 124 spaces



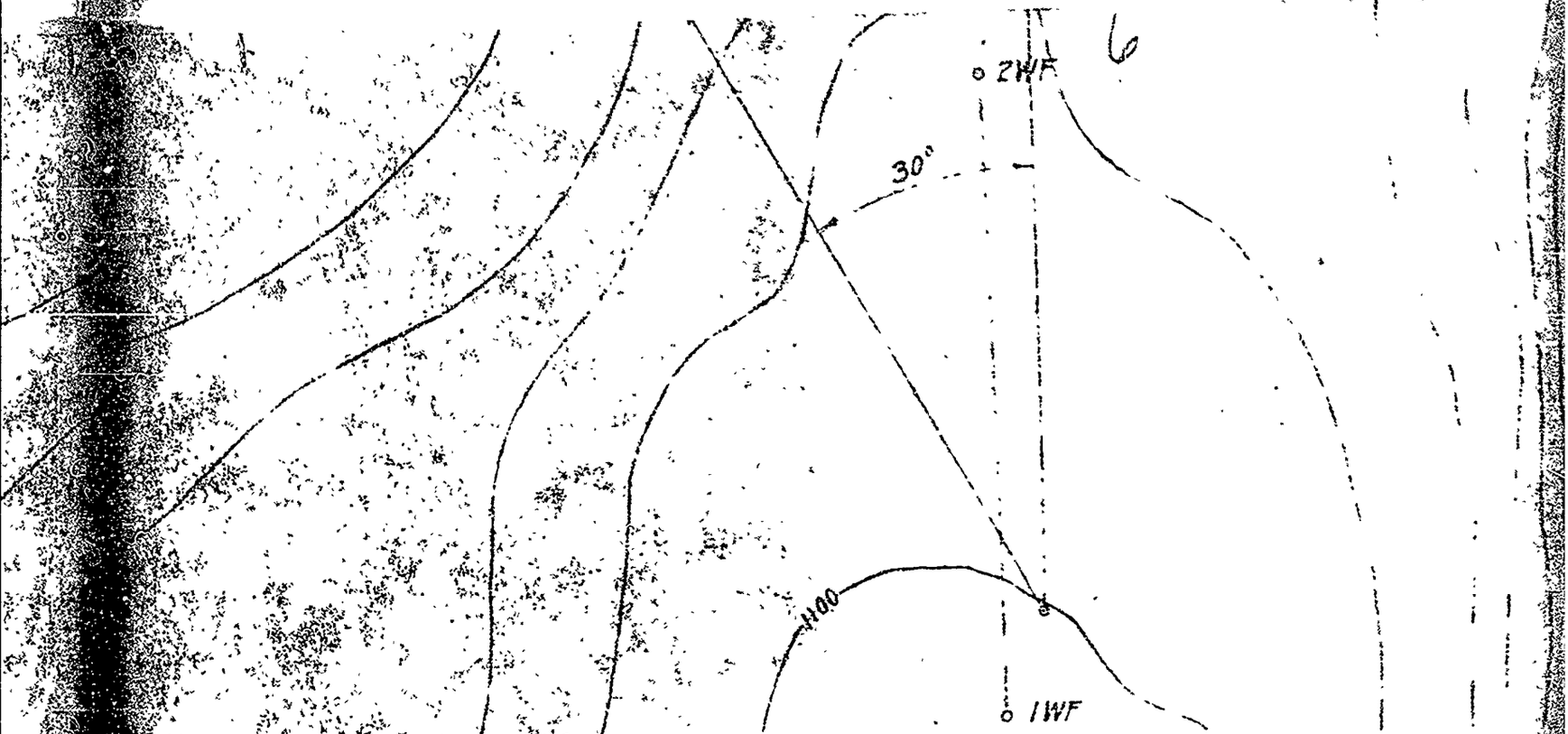
PLAN OF SPILLWAY

Scale :- 1/4" = 1'0"



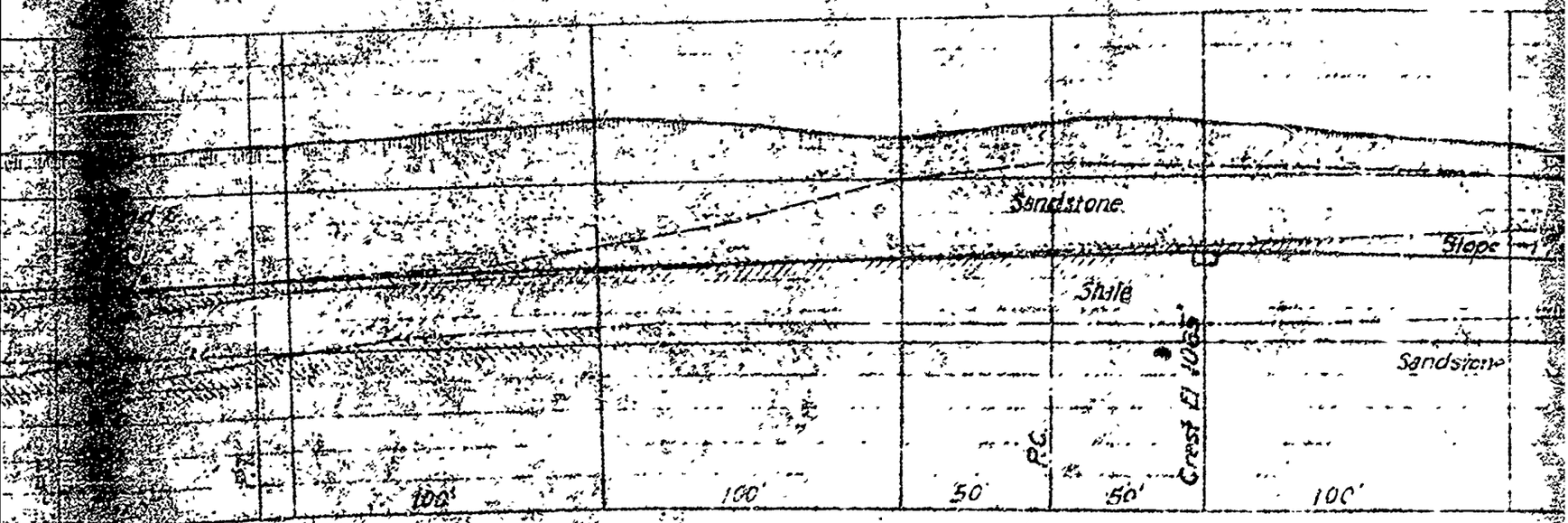

1050
1100
1075
1050
1025
Topsoil, Sand &
Boulders
Grade of Bottom of Cut Slope 1%
100
100
100
100

PROFI



PLAN

Scale 1"=50'



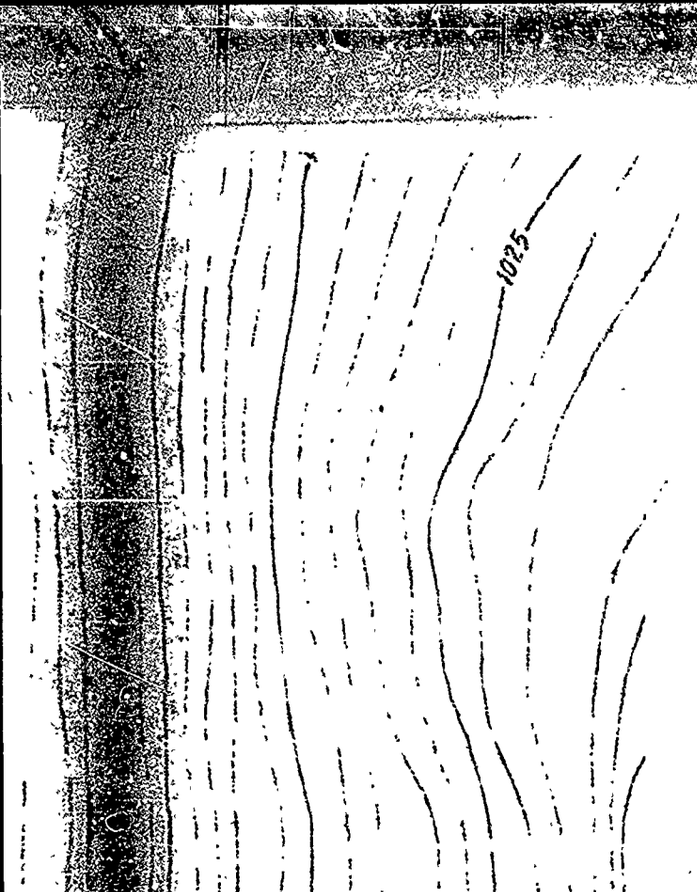
PROFILE ON ℄ OF SPILLWAY

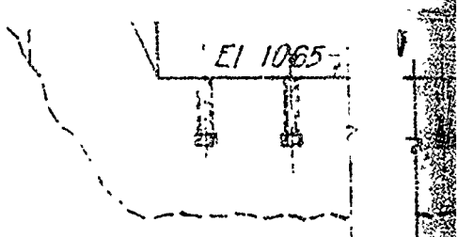
Horizontal Scale: 1"=50'

Vertical Scale: 1"=25'

(Grade of rock lines approximate only!)

Side slopes in Rock to be 1:2, in Sand & Gravel slope to be 1:1, to 1:3 above Grade of bottom of Cut and slo

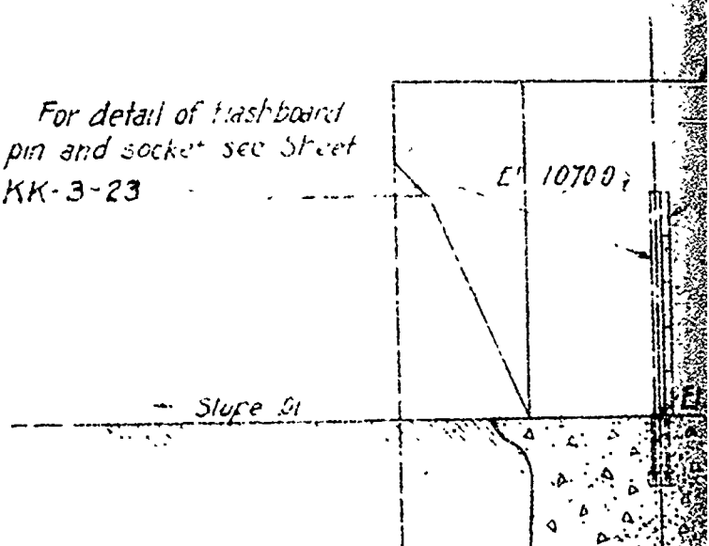




SECTION

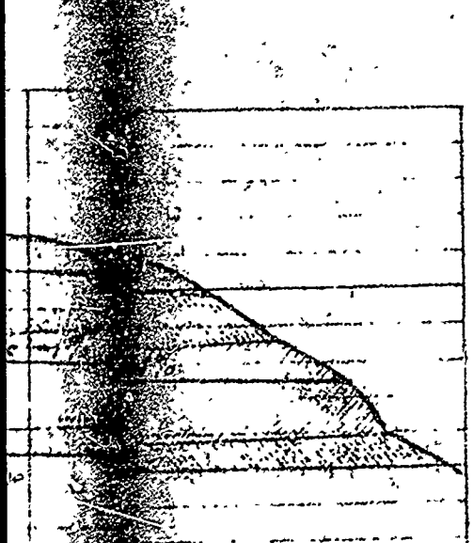
Scale: 1/4"

For detail of flashboard pin and socket see Sheet KK-3-23



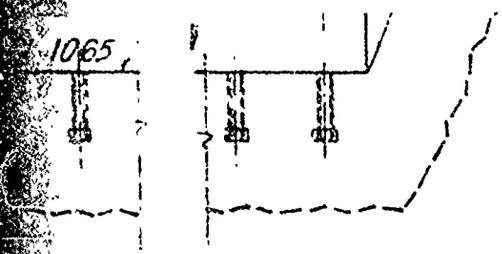
3:0"

SECTION



Quantities :-

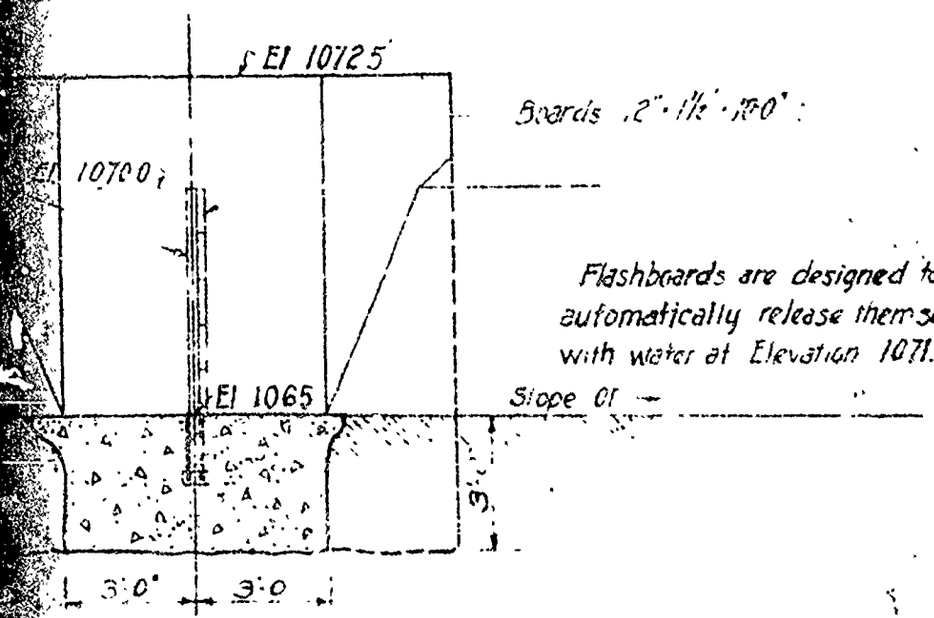
Excavation - Sand & Boulders	83,000 cy
Excavation - Rock	33,000 cy.
Riprap	1,800 sy
Concrete at Spillway	200 cy.



8

SECTION "A-A"

Scale: 1/4" = 1'-0"

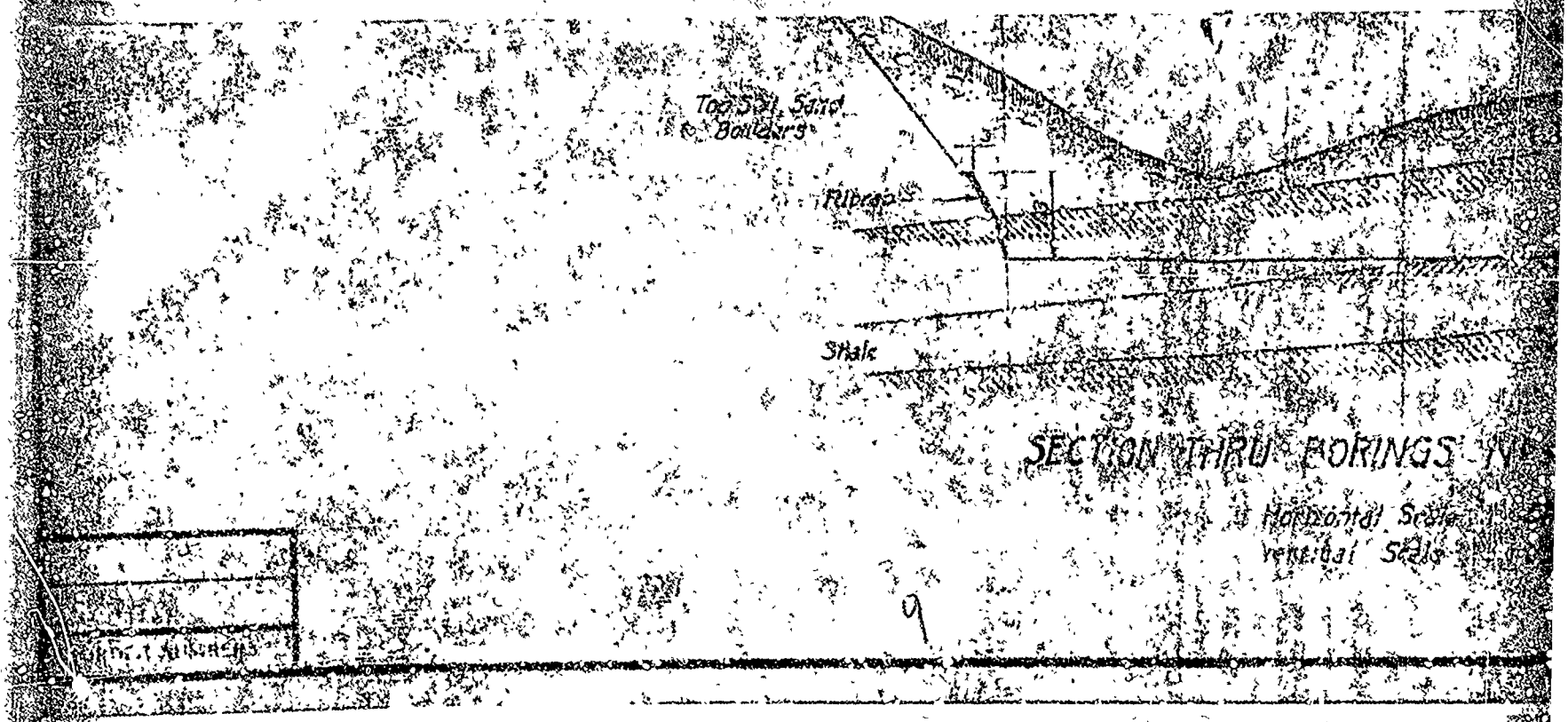


SECTION "B-B"

APPROVED:-

CHAS. T. MAIN, CONSULTING ENGR.

200 DEVONSHIRE ST



SECTION THRU BORINGS

Horizontal Scale
Vertical Scale

Riprapped, leave 3' Berm above Riprap, all other side slopes in Sand & Gravel to be 1½ : 1.

All rock surfaces shall be reasonably smooth and sound. Bad places shall be improved with concrete.

10

CATSKILL

REVISIONS

11

BOSTON, MASS.

BY Chas. A. Main

KILL ILL POWER CORP. MIDDLETOWN, N.Y.

ONS

SWINGING BRIDGE
DEVELOPMENT
SPILLWAY

PREPARED BY CHARLES H TENNEY & CO.
ENGINEERS — BOSTON, MASS.

Drawn	Traced	Checked
D.V.C.B.	D.V.C.B.	

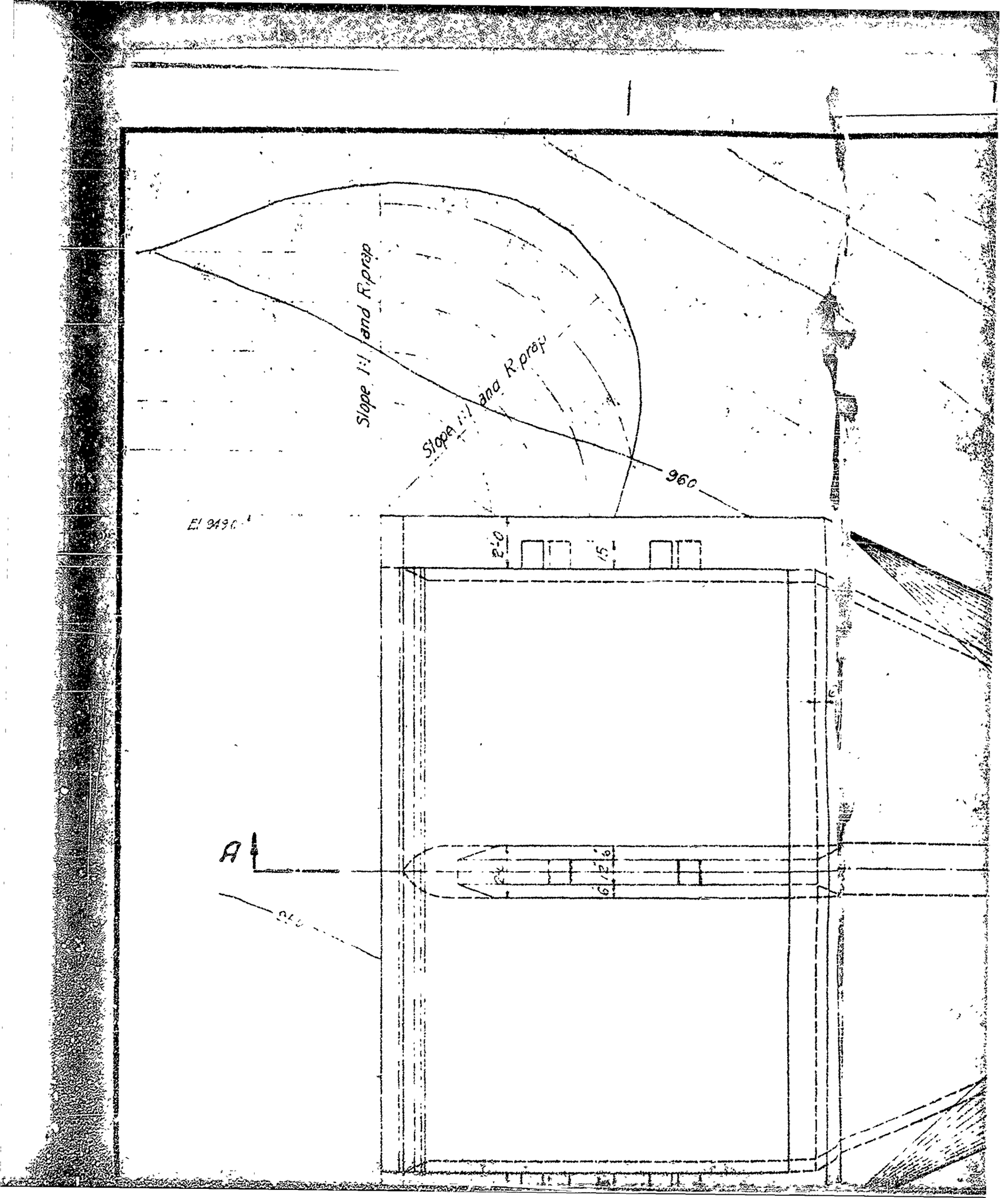
Examined:

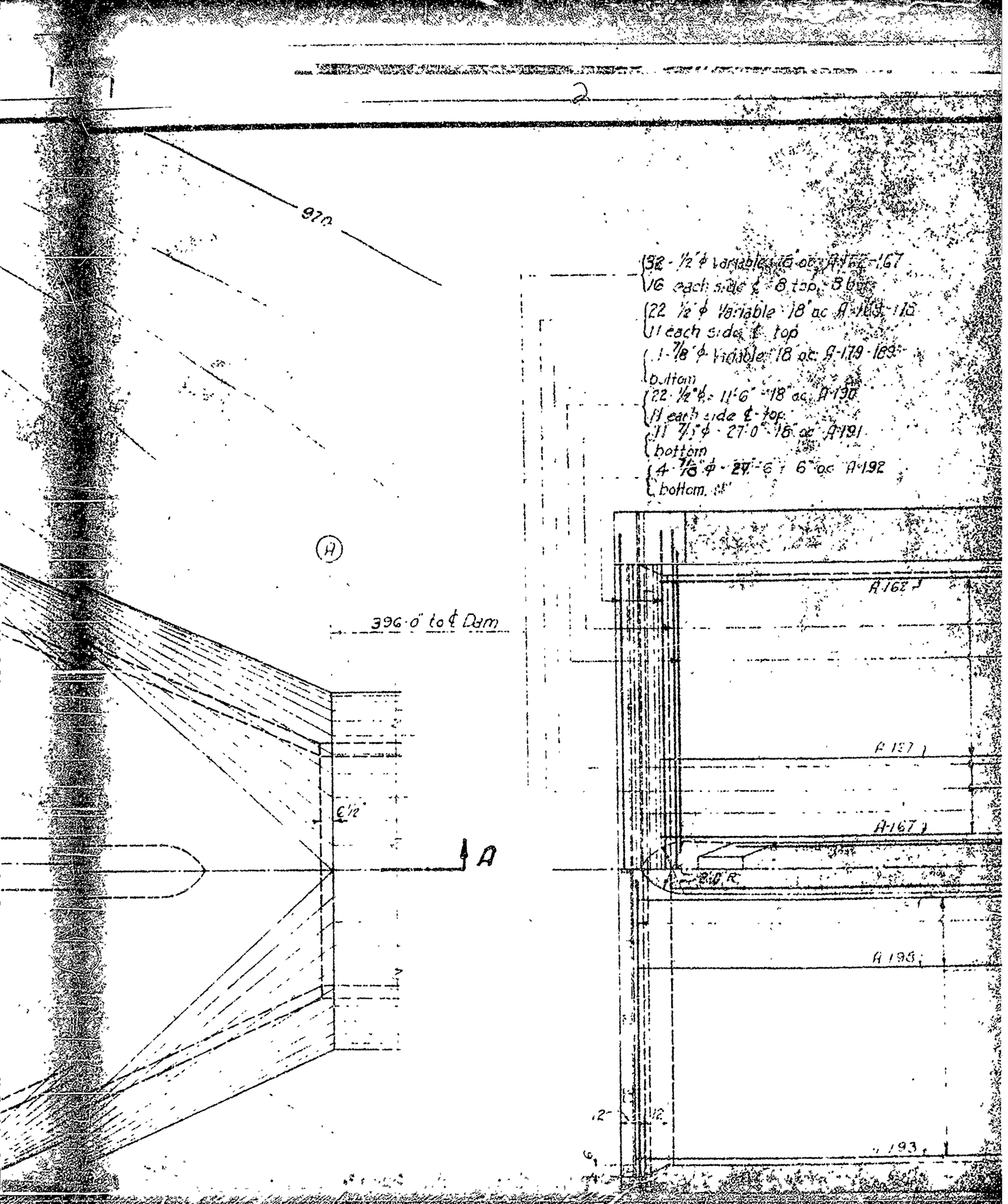
1st. Assistant

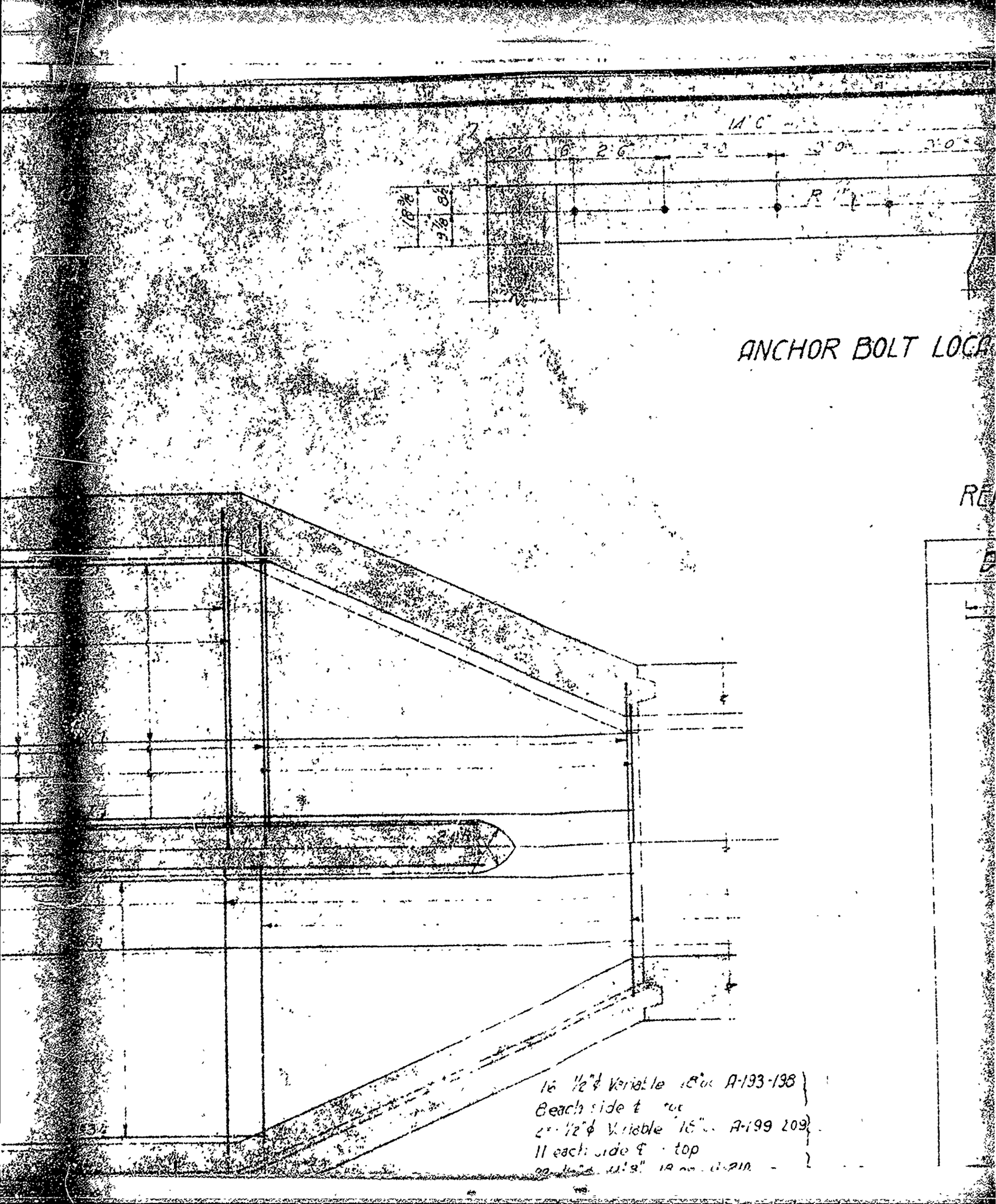
Approved: W. T. Tenney

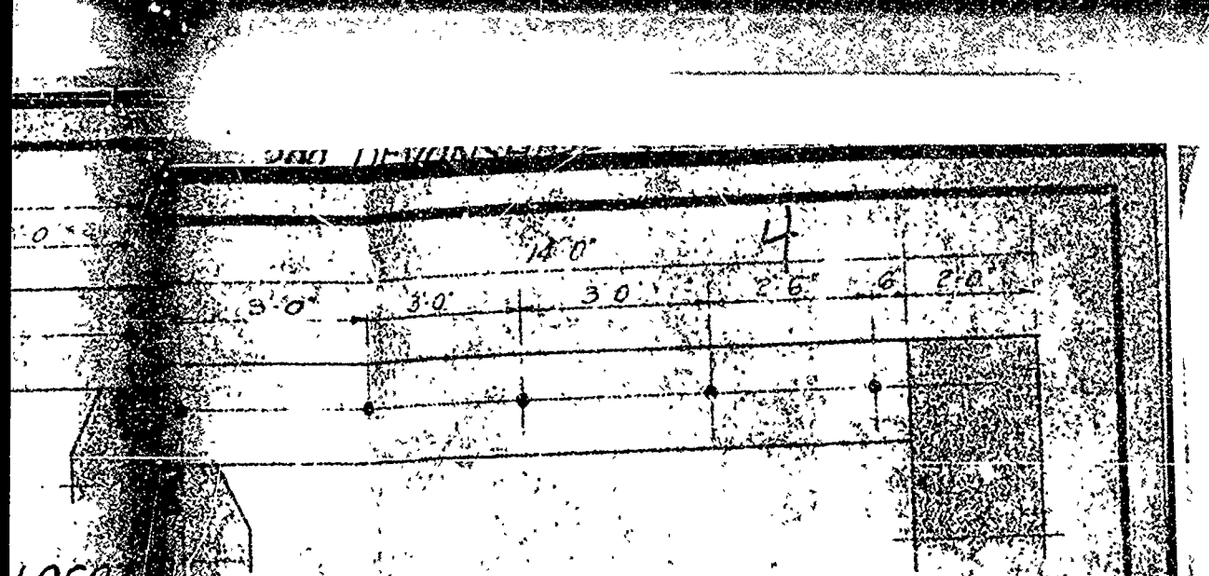
SCALES				
1"=50'	1"=25'	1/4"=1'0"	SEPT. 1923	KK 3 18

25 x 38


Slope 1:1 and Riprap
Slope 1:1 and Riprap
960
El 949.0
2:0
15'
A


97m
32 - 1/2" ϕ Variable 18" oc A-166 - 167
16 each side ℄ top, 8 bot
22 1/2" ϕ Variable 18" oc A-168 - 170
11 each side ℄ top
1 - 7/8" ϕ Variable 18" oc A-179 - 189
bottom
22 - 1/2" ϕ - 11'-6" - 18" oc A-190
11 each side ℄ top
11 - 7/8" ϕ - 27'-0" - 18" oc A-191
bottom
4 - 7/8" ϕ - 27'-6" - 6" oc A-192
bottom
A
396'-0" to ℄ Dam
A 162
A 167
A-167
A 193
193
℄1/2"
A


14'-0"
2'-0"
1'-6"
2'-6"
3'-0"
3'-0"
18 3/8"
9 3/8"
ANCHOR BOLT LOCA
RE
16 1/2"ϕ Variable 18"o/c A-193-198
Each side ℄ top
2 - 1/2"ϕ Variable 18"o/c A-199 209
11 each side ℄ top



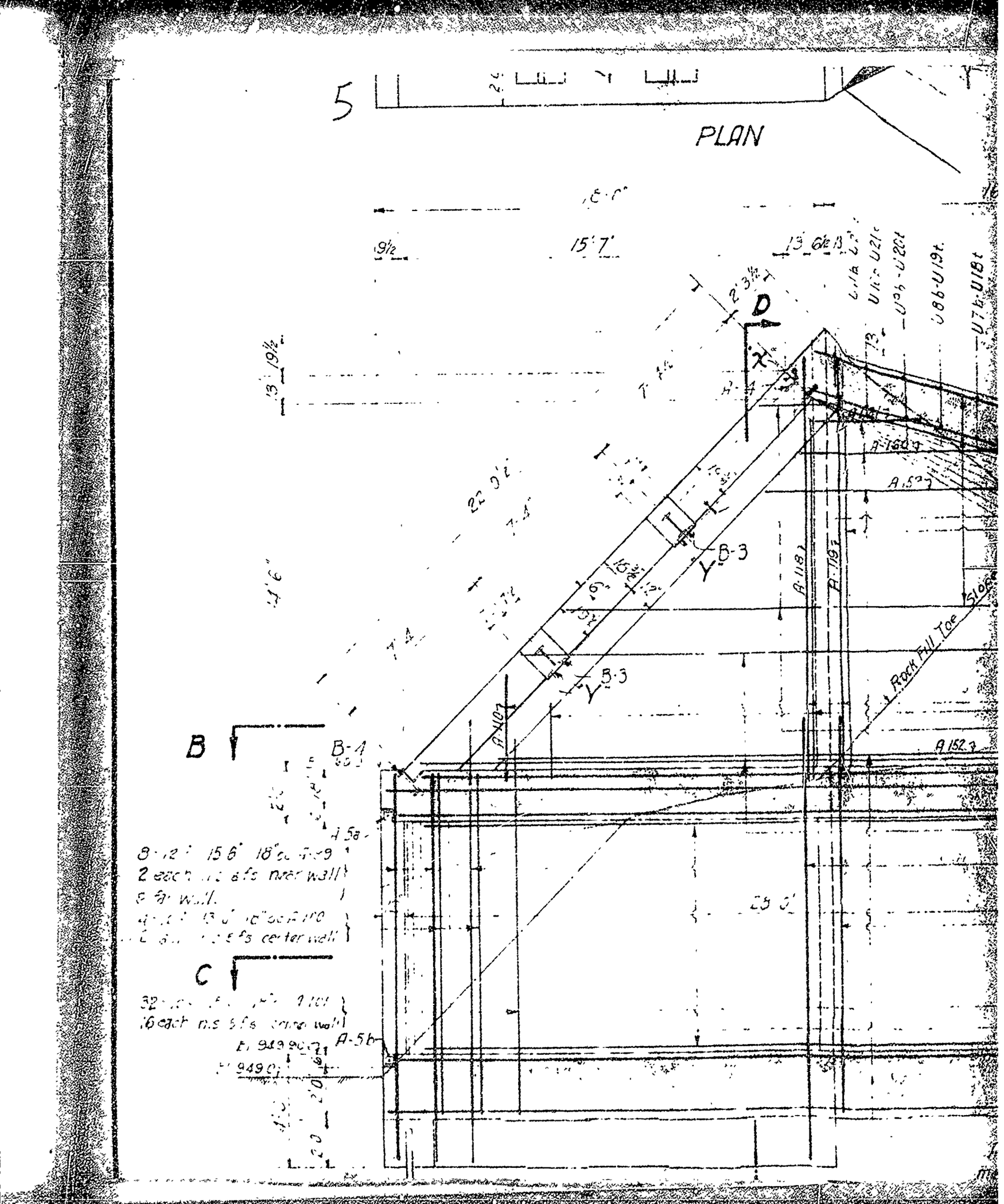
LOCA

TION DETAIL AT 'X'

REI

NFORCEMENT SCHEDULE

DESCRIPTION	Mark	No Reqd	Size	Length
Length	A 99	8	½" ϕ	15'-6"
	A 100	4	½" ϕ	13'-0"
	A 101	32	½" ϕ	15'-0"
	A 102	2	⅞" ϕ	26'-0"
	A 103-109	14 (2 ea)	½" ϕ	16'-0 to 13'-3"
	A 110-118	36 (4 ea)	½" ϕ	3'-9" to 16'-0" *
	A 119-129	44 (4 ea)	½" ϕ	16'-0 to 4'-6"
	A 130-137	16 (2 ea)	½" ϕ	20'-0 to 12'-9"
	A 138-143	24 (4 ea)	½" ϕ	9'-0 to 10'-6" *
	A 144-147	16 (4 ea)	½" ϕ	28'-3" to 32'-6" *
	A-148	40	½" ϕ	17'-6"
	A-149	44	½" ϕ	15'-6"
	A-150	32	½" ϕ	33'-6"
	A 151	14	½" ϕ	26'-0"
	A 152-159	16 (2 ea)	½" ϕ	22'-6 to 12'-0"
	A 160-161	4 (2 ea.)	½" ϕ	8'-6 to 4'-0"
	A 162-166	20 (4 ea.)	½" ϕ	17'-6" to 30'-6"
	A 167	12	½" ϕ	32'-0"
	A 168-178	22 (2 ea.)	½" ϕ	11'-0 to 4'-6"
	A 179-189	11	⅞" ϕ	26'-6" to 13'-9"
	A 190	22	½" ϕ	11'-6"
	A 191	11	⅞" ϕ	27'-0"
	A 192	4	⅞" ϕ	2'-6"


5
PLAN
15'7"
9½
13'6½"
2'3½"
D
13'19½"
A-160.7
A-153.7
22'0"
B-3
B-3
A-118.7
A-119.7
S106.6
Rock Fill Toe
A-152.7
A-140.7
B
B-1
C
A-58.
A-56.
29'0"

SECTION "BE

16'-0"

U7 b-U18 t

U6 b-U13 t

U7 b-U18 t

U6 b-U17 t

U5 b-U16 t

U4 b-U15 t

U3 b-U14 t.

U2 b-U13 t

U1 bot U12 top.

Slope 1 3½

Slope 1:1

Slope 1:1

Toe

Toe

Rock Fill

El. 965.78

El. 960.73

El. 949.73

A 152 ?

A 152 ?

A 129

2'-6"

2'-6"

15'-9"

2-7/8"ϕ - 20'-6" - 12" o.c. A-102

14 - ½ ϕ Variable 18" o.c. A-103-109
7 each n.s. & f.s. center wall

Spacers ½ ϕ 18" o.c. (approx.)
n.s. & f.s., t. & b. n. wall & f. wall

80 - ½ ϕ Variable 18" o.c. A-110-129
20 each n.s. & f.s. n. wall & f. wall

16 - ½ ϕ Variable 18" o.c. A-130-137
8 each n.s. & f.s. center wall

B

24 - ½" ϕ Variable 18" o.c. A-138-143
6 each n.s. & f.s. n. wall and f. wall

16 - ½" ϕ Var. 18" o.c. A-144-147
4 each n.s. & f.s. n. wall & f. wall

40 - ½ ϕ - 17'-6" 18" o.c. A-148
10 each n.s. & f.s. n. wall & f. wall

44 - ½" ϕ - 15'-6" 18" o.c. A-149.
11 each n.s. & f.s. n. wall & f. wall

C

32 - ½" ϕ 33'-6" - 18" o.c. A-150
8 each n.s. & f.s. n. wall & f. wall

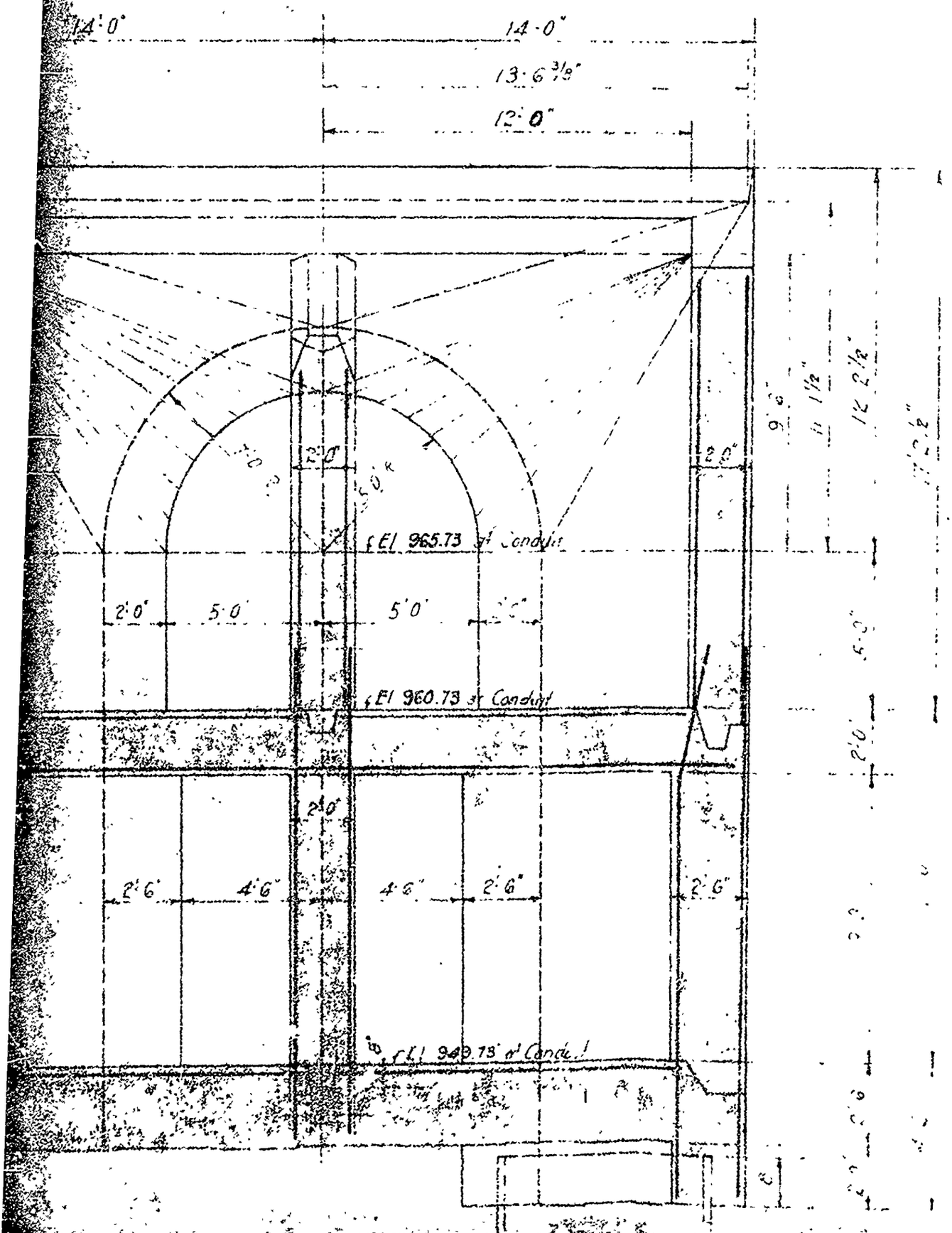
14 - ½" ϕ 26'-0" 18" o.c. A-151
each n.s. & f.s. center wall

20 - ½ ϕ Variable 18" o.c. A-152-161
10 each n.s. & f.s. center wall

All longitudinal Conduit reinforcement to be carried through out

...li each side ℄ - top

...3B" ABOVE ℄ - SECTION "CC" BELOW ℄.



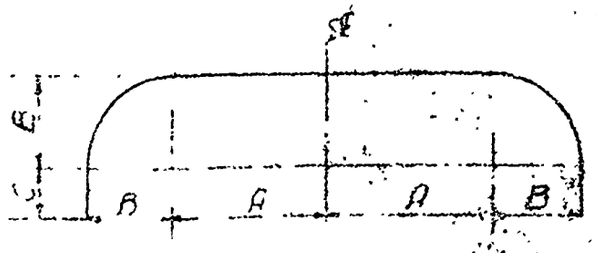
	A 193-197	10 (2 ea)	1/2" ϕ	31'6" to 18'0"
	A 198	6	1/2" ϕ	32'9"
	A 199-209	22 (2 ea)	1/2" ϕ	10'6" to 6'0"
	A 210	22	1/2" ϕ	11'3"
Spacers		1000 lf	1/2" ϕ	

8

* Cut bars to fit at "Y"
Use deformed bars

BENDING TABLE FOR U-1 to U-22

Mark	A	B	C	Length	Mark	A	B	C	Length
U-1	0'0"	5'3"	1'0"	16'6"	U-12	0'6"	6'6"	1'0"	23'3"
U-2	1'2"	4'9"	1'0"	19'3"	U-13	1'9"	5'9"	1'0"	23'9"
U-3	2'5"	4'4"	1'0"	20'0"	U-14	3'2"	5'1"	1'0"	24'3"
U-4	3'5"	3'10"	1'0"	21'0"	U-15	4'6"	4'5"	1'0"	25'0"
U-5	4'6"	3'5"	1'0"	21'9"	U-16	5'11"	3'8"	1'0"	25'3"
U-6	5'8"	2'10"	1'0"	22'6"	U-17	7'3"	3'0"	1'0"	25'9"
U-7	6'9"	2'5"	1'0"	23'3"	U-18	8'7"	2'3"	1'0"	26'3"
U-8	7'11"	1'11"	1'0"	24'0"	U-19	9'11"	1'7"	1'0"	26'9"
U-9	9'0"	1'6"	1'0"	24'9"	U-20	11'4"	0'10"	1'0"	27'3"
U-10	10'2"	1'0"	1'0"	25'6"	U-21	12'8"	0'2"	1'0"	27'9"
U-11	11'5"	0'7"	1'0"	26'3"	U-22	13'6"	0'0"	1'0"	29'0"



TYPICAL U-BAR FOR TOP OF INTAKE
Use 1/8" ϕ See Above Table
Mk ... of each

APPROVED:
CHAS. T. MAIN, CONSULTING ENGR.

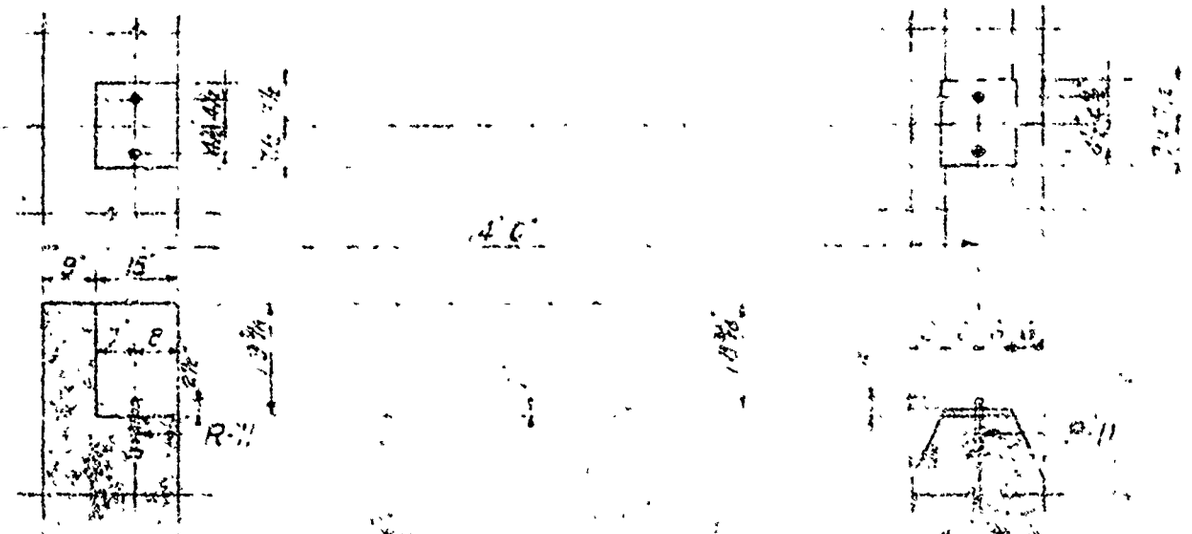
3" Spacing Sheeting
12'0" lg.

D

SECTION 'AA'

ORDER

Construction joints.



ANCHOR BOLT LOCATION DETAIL AT Y

10

DO"

Notes:-

Concrete Mix 1:2:4 (2000#

All Reinforcing Steel to be 3 from face of forms

For General Location & Connecting Structures

see drawings KK-3-17 & KK 3-26.

For Trash Rack Steel Details see drawing

KK-3-24.

CATSKIL

REVISIONS

200 DEVONSHIRE ST.
BOSTON, MASS.
BY Chas T. Main

SKILL[illegible] SKILL POWER CORP. - MIDDLETOWN, N.Y.

ISIONS	SIONS

SWINGING BRIDGE DEVELOPMENT INTAKE

PREPARED BY CHARLES H TENNEY & CO.
ENGINEERS BOSTON, MASS.

SCALE 1/4" : 1'0"

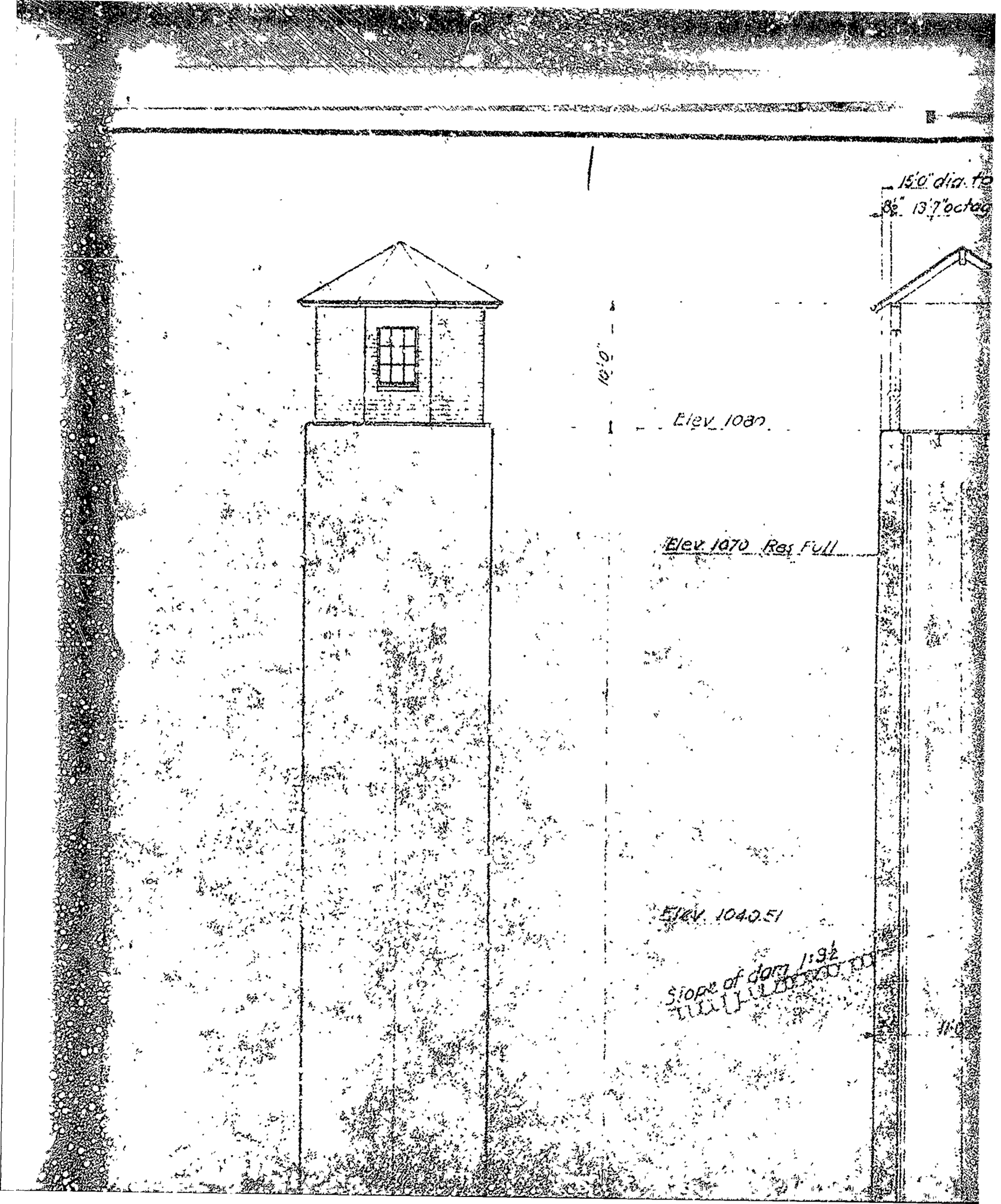
OCT 1925

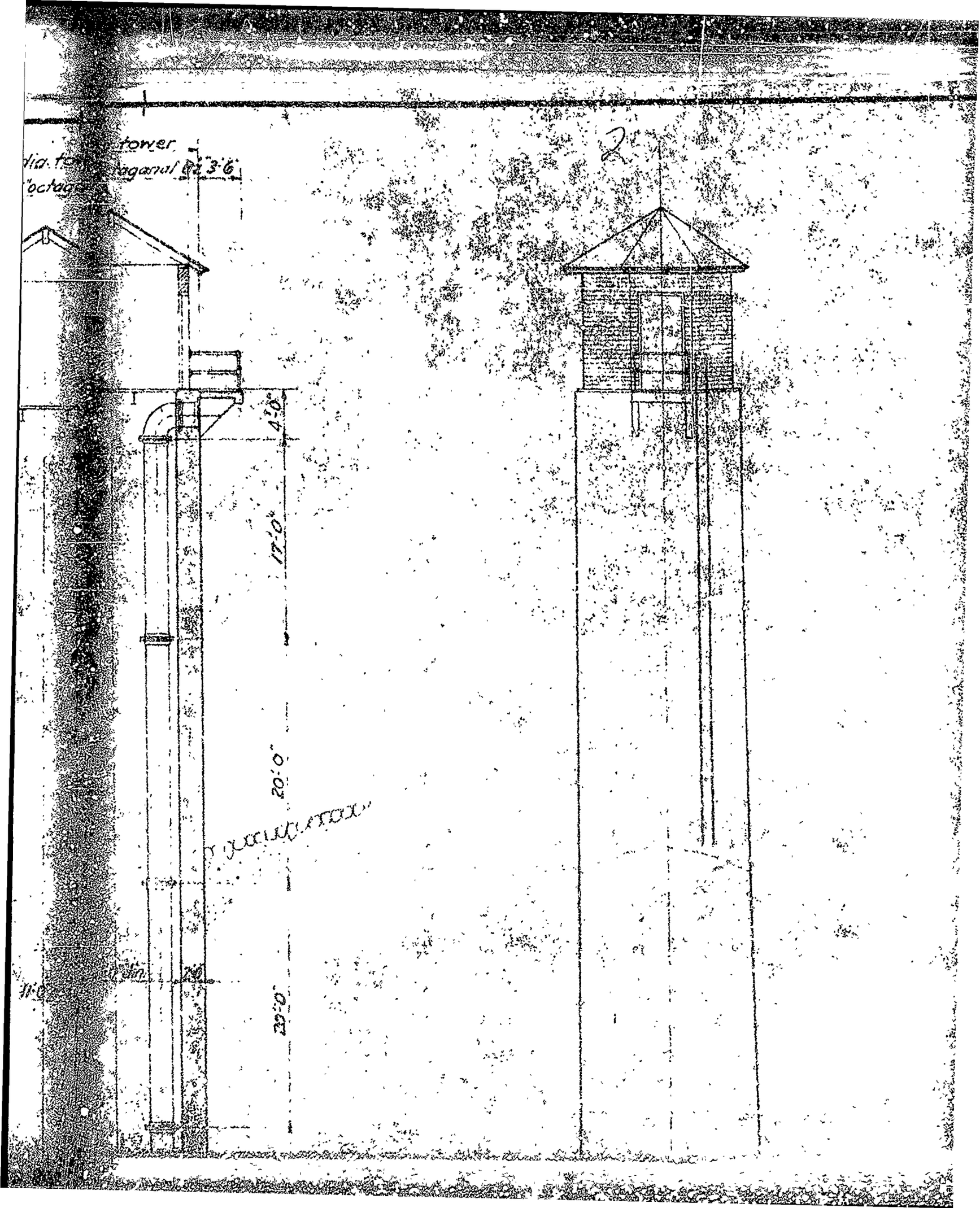
Drawn	Traced	Checked
D.V.C.B.	D.V.C.B.	

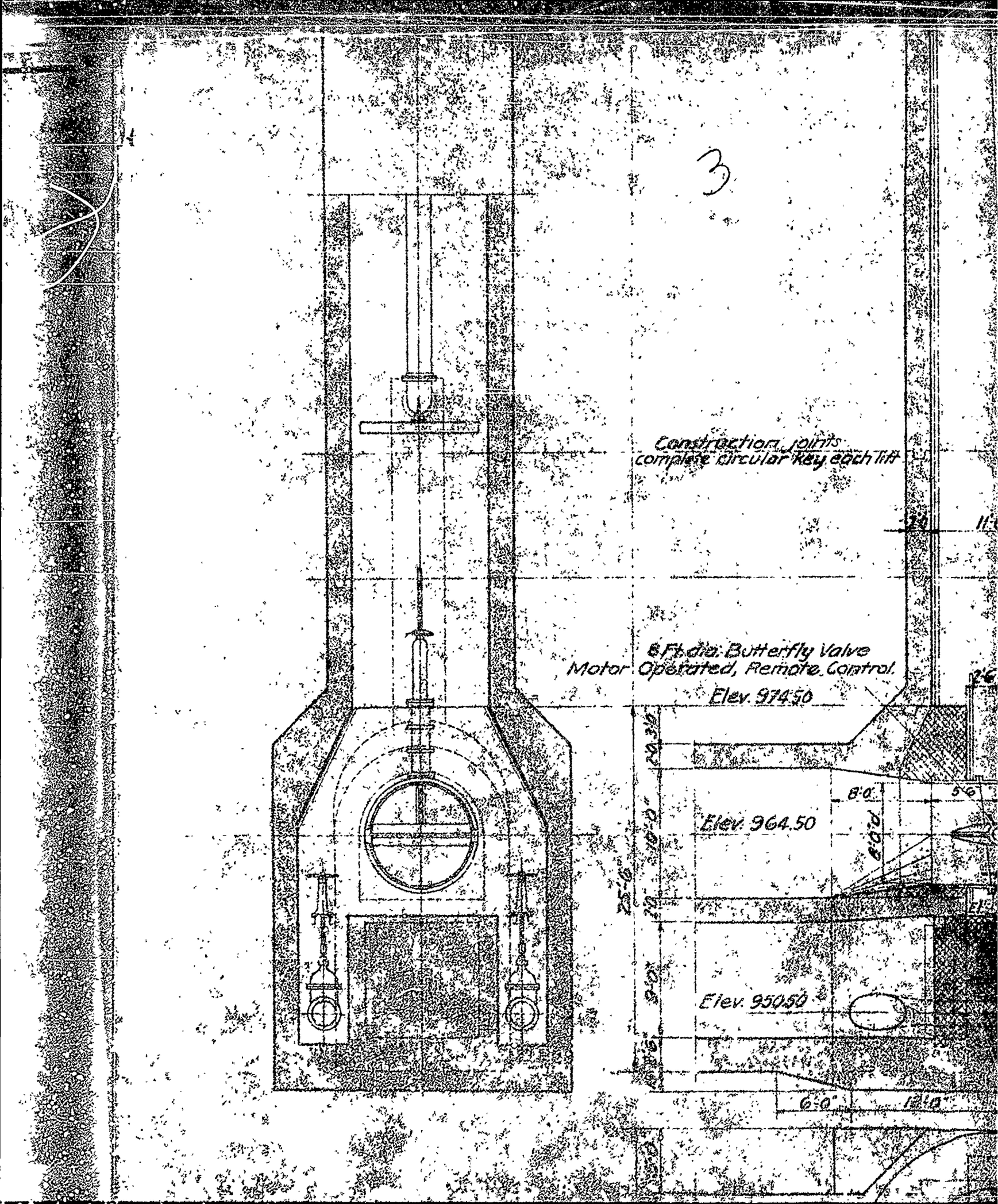
Recommended:

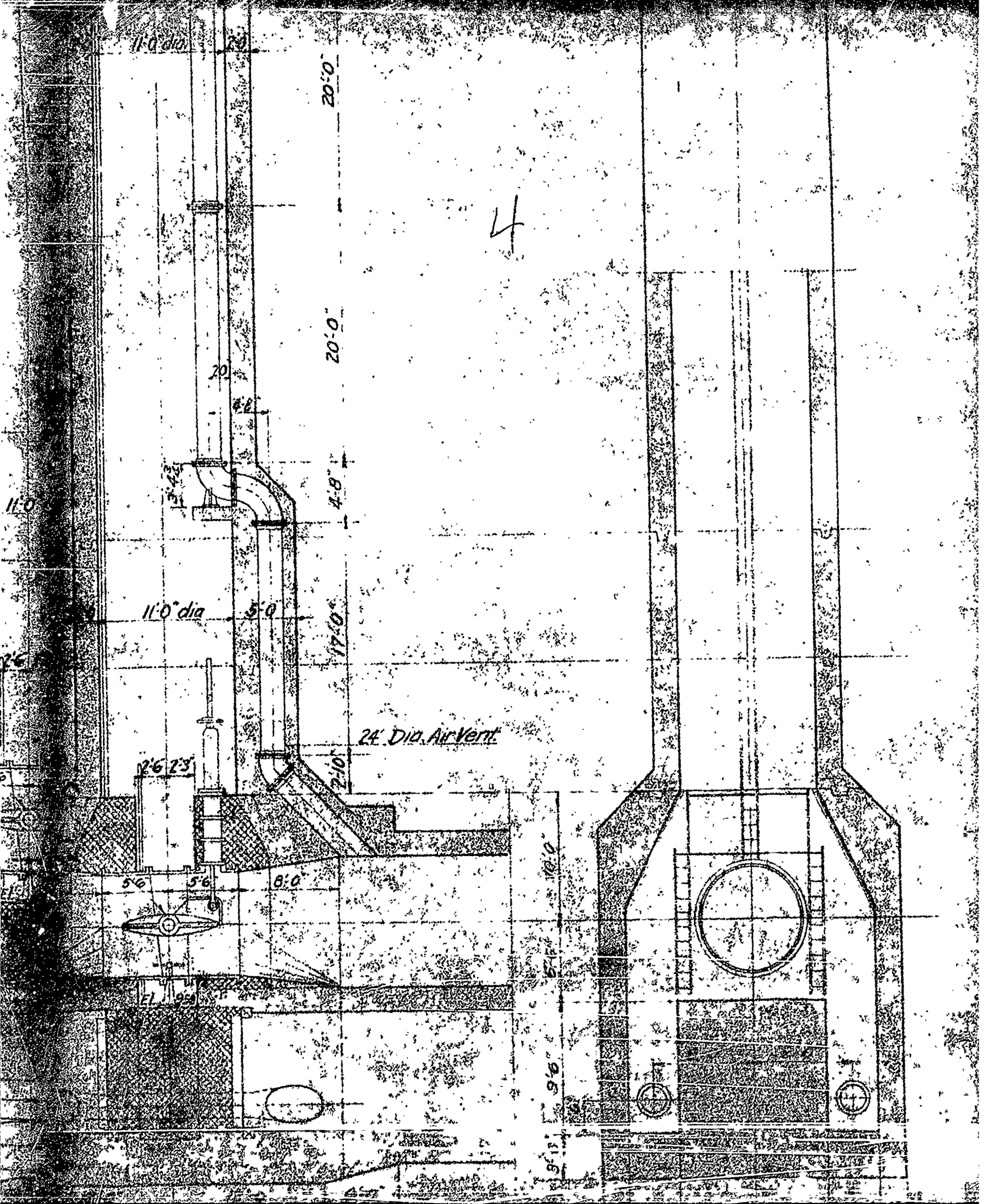
Approved: [signature]

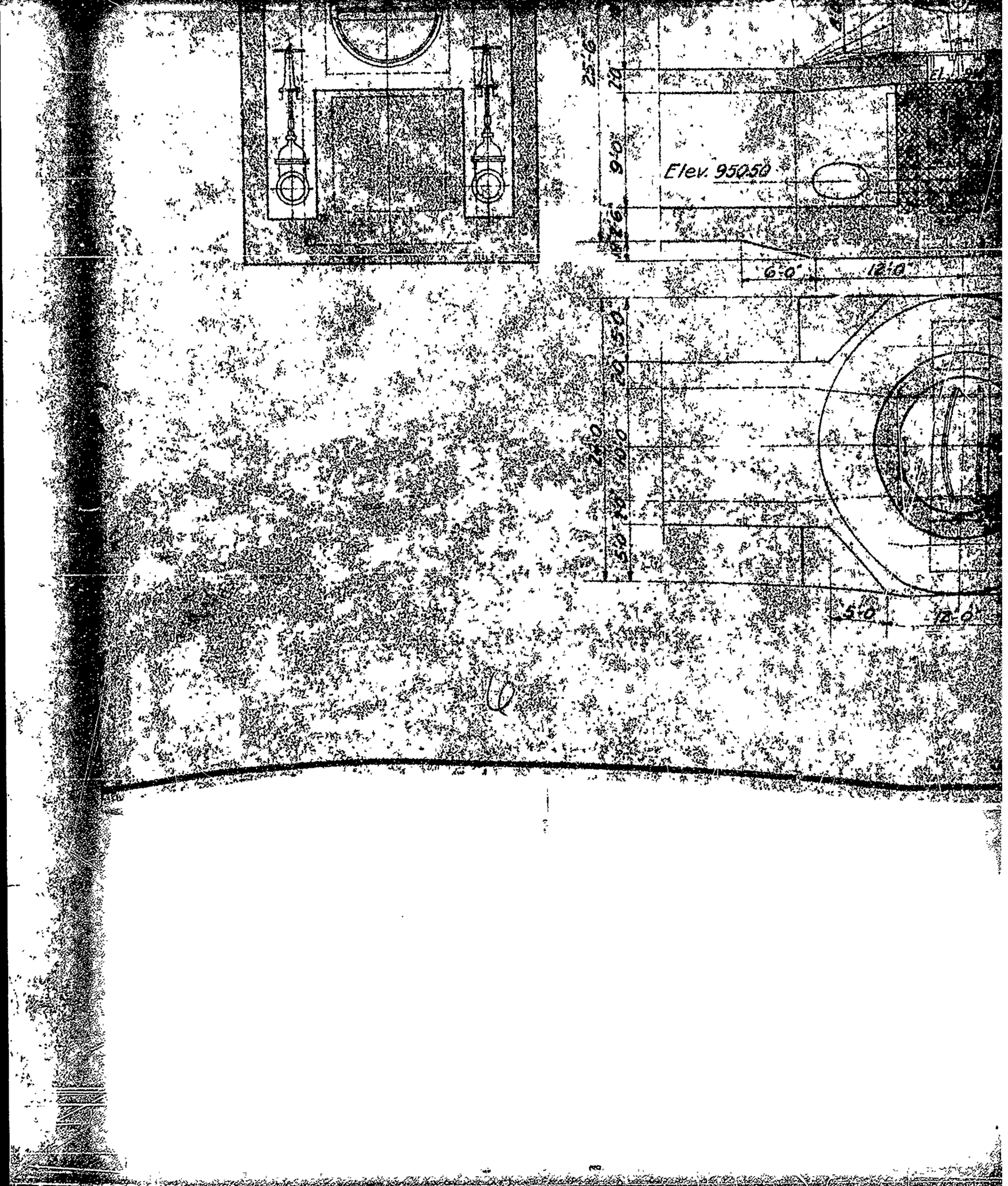
KK 3 19


15'0" dia. to
8½" 13'7" octag
16'0"
Elev 1080
Elev 1070 Res Full
Elev 1040.51
Slope of dam 1:9½


tower
dia. to
octago
diagonal @ 2'3"6
4'-0"
17'-0"
20'-0"
22'-0"


3
Construction joints complete circular key each lift
6 Ft. dia. Butterfly Valve Motor Operated, Remote Control.
Elev. 974.50
Elev. 964.50
Elev. 950.50
8'-0"
6'-0"
6'-0"
25'-6"
20'-0"
30'-0"
6'-0"


11'0" dia
20'-0"
20'-0"
4'8"
11'0" dia
5'0
17'10"
24" Dia. Air Vent
2'10"
2'6
2'3"
5'6
5'6
8'0
10'0
9'6"
EL 959


25-6
29
9-4-0
Elev. 950.50
6-0
12-0
20-5-0
24-0
10-0
30-0
5-0
12-0

APPROVED:-
CHAS. T. MAIN, CONSULTING ENGR.
200 DEVONSHIRE ST.
BOSTON, MASS.
BY W. T. Main

CATSKILL POWER CORP. MIDDLETOWN N.Y.

REVISIONS		

SWINBURNE BRIDGE DEVELOPMENT
GATE TOWER

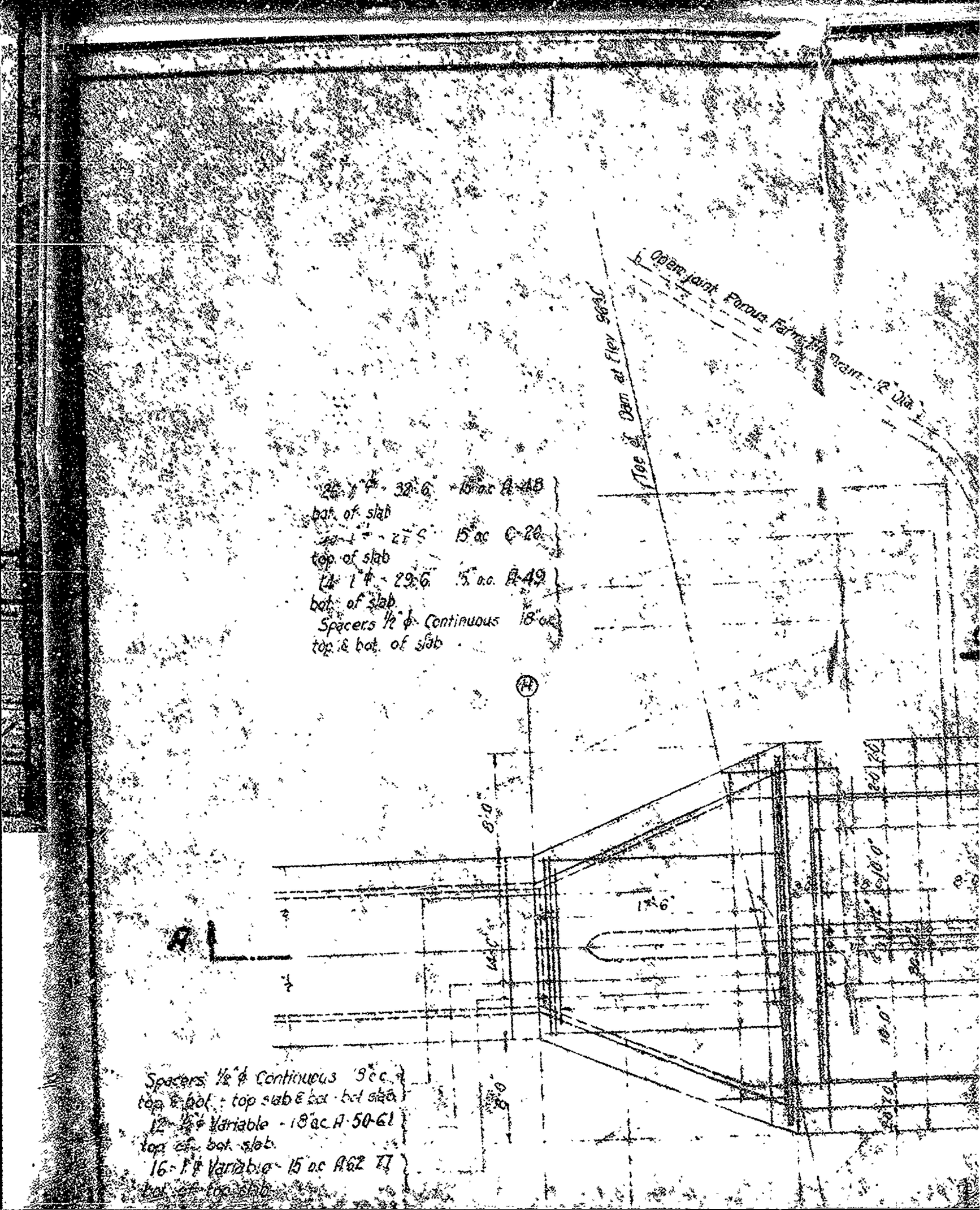
PREPARED BY CHARLES T. MAIN & CO. ENGINEERS BOSTON, MASS.

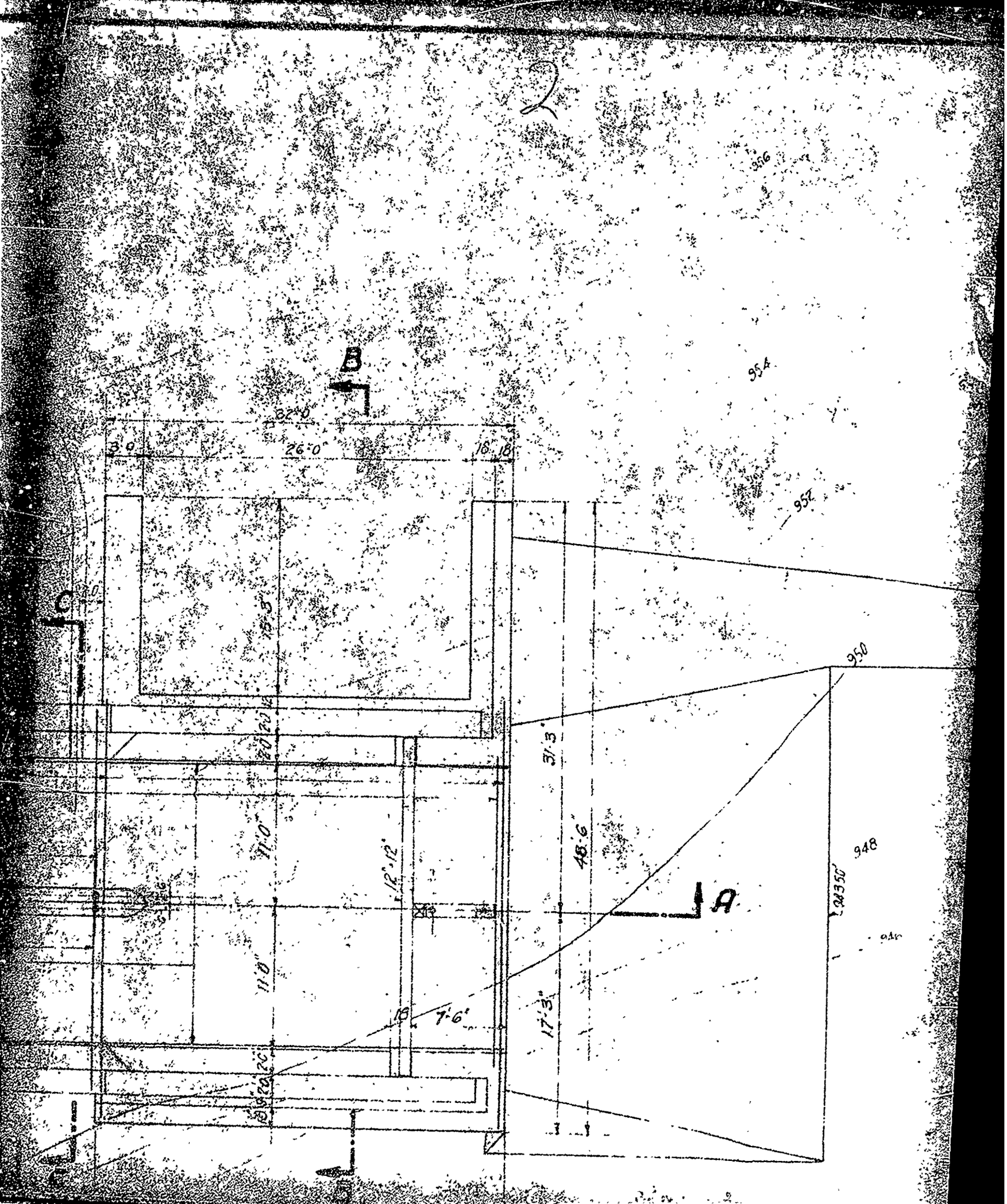
SCALE 1/4"

DATE 20 Feb 21

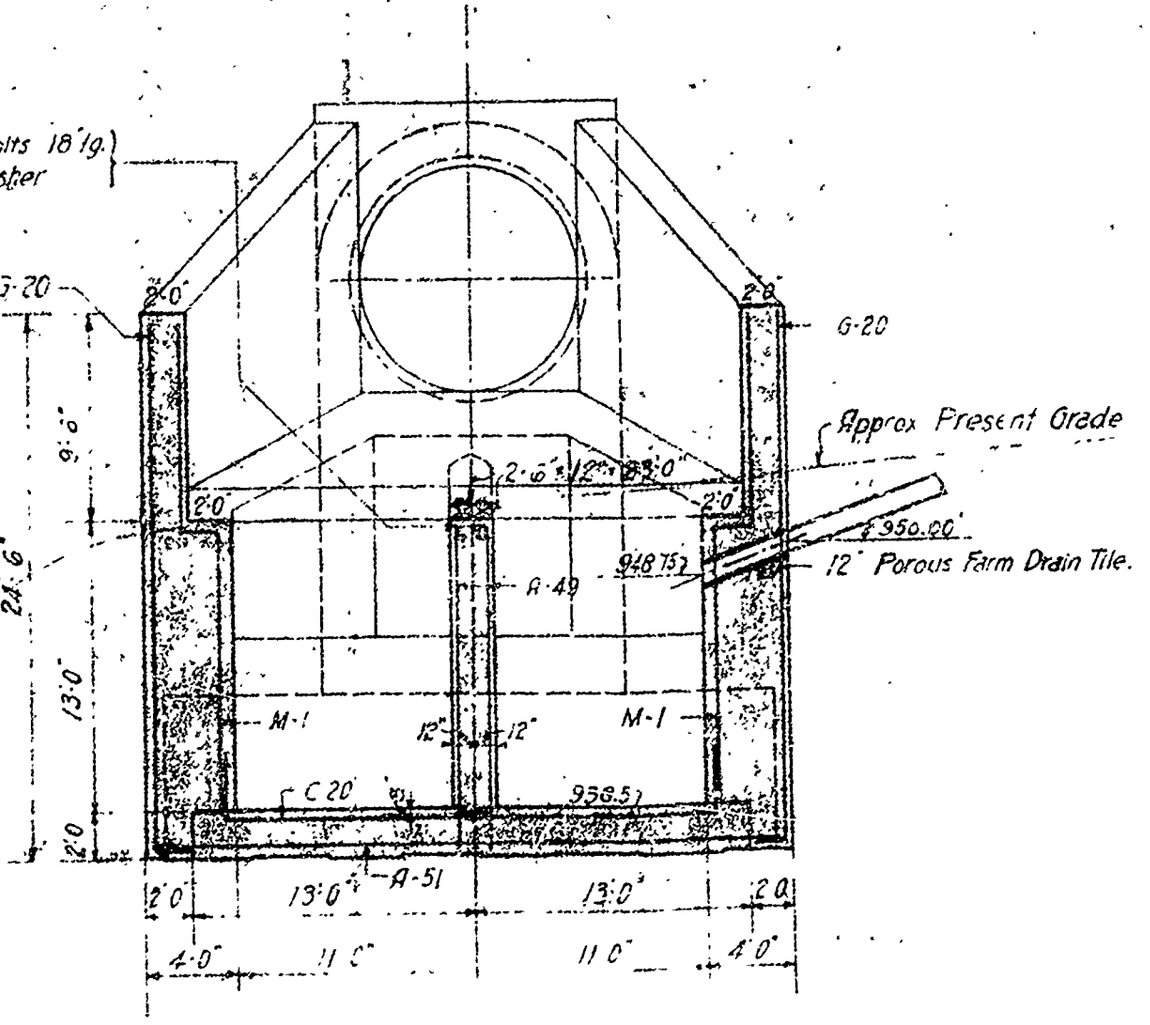
SHEET 3

TENNEY & CO


Toe of Dam at Elev 968.0
Open Joint. Porous Felt
Grout - 12 Dia
25 - 1" ϕ - 32'-6" - 15" o.c. A-48
bot. of slab
25 - 1" ϕ - 21'-5" - 15" o.c. A-20
top of slab
14 - 1" ϕ - 29'-6" - 15" o.c. A-49
bot. of slab
Spacers 1/2" ϕ Continuous 18" o.c.
top & bot. of slab
(A)
8'-0"
17'-6"
A
Spacers 1/2" ϕ Continuous 18" o.c.
top & bot. - top slab & bot slab
12 - 1 1/2" ϕ Variable - 18" o.c. A-50-61
top of bot. slab
16 - 1" ϕ Variable - 15" o.c. A62 71
bot. of top slab


B
82'-0"
3'-0"
26'-0"
18'
18'
C
15'-3"
31'-3"
48'-6"
11'-0"
12"
12"
7'-6"
17'-3"
A
956
954
952
950
948
946
944

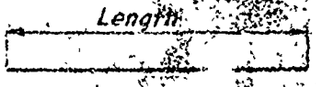
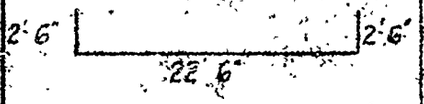
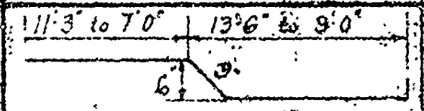
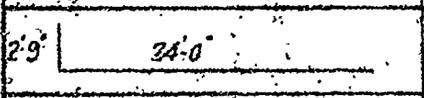
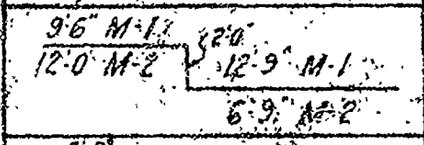
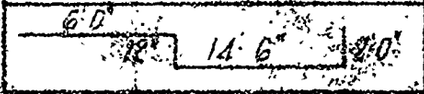
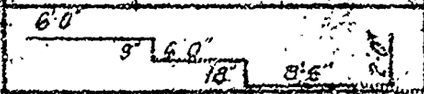
3


6-1¼ Anchor Bolts 18"lg.)
With nut & washer
G-20
2'-0"
G-20
Approx Present Grade
2'-6"
12"
3'-0"
2'-0"
2'-0"
℄ 950.00
948.75
12" Porous Farm Drain Tile.
9'-0"
24'-6"
A-49
13'-0"
M-1
12"
12"
M-1
C 20
956.5
2'-0"
A-51
2'-0"
13'-0"
13'-0"
2'-0"
4'-0"
11'-0"
11'-0"
4'-0"

"C-C"

4

REINFORCEMENT SCHEDULE

DESCRIPTION	Mark	N° Req'd	Size	Length
	A-20 to 35	16	5/8" ϕ	16'-6" to 25'-0"
	A 36 to 46	11	1/2" ϕ	8'-6" to 11'-6"
	A-47	20	1/2" ϕ	12'-6"
	A-48	26	1" ϕ	32'-6"
	A-49	14	1" ϕ	29'-6"
	A 50-61	12	1/2" ϕ	10'-6" to 28'-6"
	A 62-77	16	1" ϕ	13'-6" to 29'-6"
	A 78-93	16	1/2" ϕ	10'-0" to 26'-0"
	C-20	40	1" ϕ	27'-6"
	E-20 to 35	32 (2 each)	5/8" ϕ	21'-6" to 16'-9"
	G-20	32	5/8" ϕ	26'-9"
	M-1	32	5/8" ϕ	24'-3"
	M-2	46	5/8" ϕ	20'-9"
	N-1	23	5/8" ϕ	23'-6"
	N-2	23	5/8" ϕ	24'-9"
		5750 l.f.	1/2" ϕ	
Spacers				

(Use deformed rods.)

top of bot. top slab & bot. bot slab
12 - #8 Variable - 18 o.c. A-50-61
top of bot. slab.
16 - #8 Variable - 15 o.c. A-62-71
bot. of top slab.
16 - #8 Variable - 15 o.c. A-78-93
top of top slab.

296'-0" to ℄ Dam.

PLAN

H

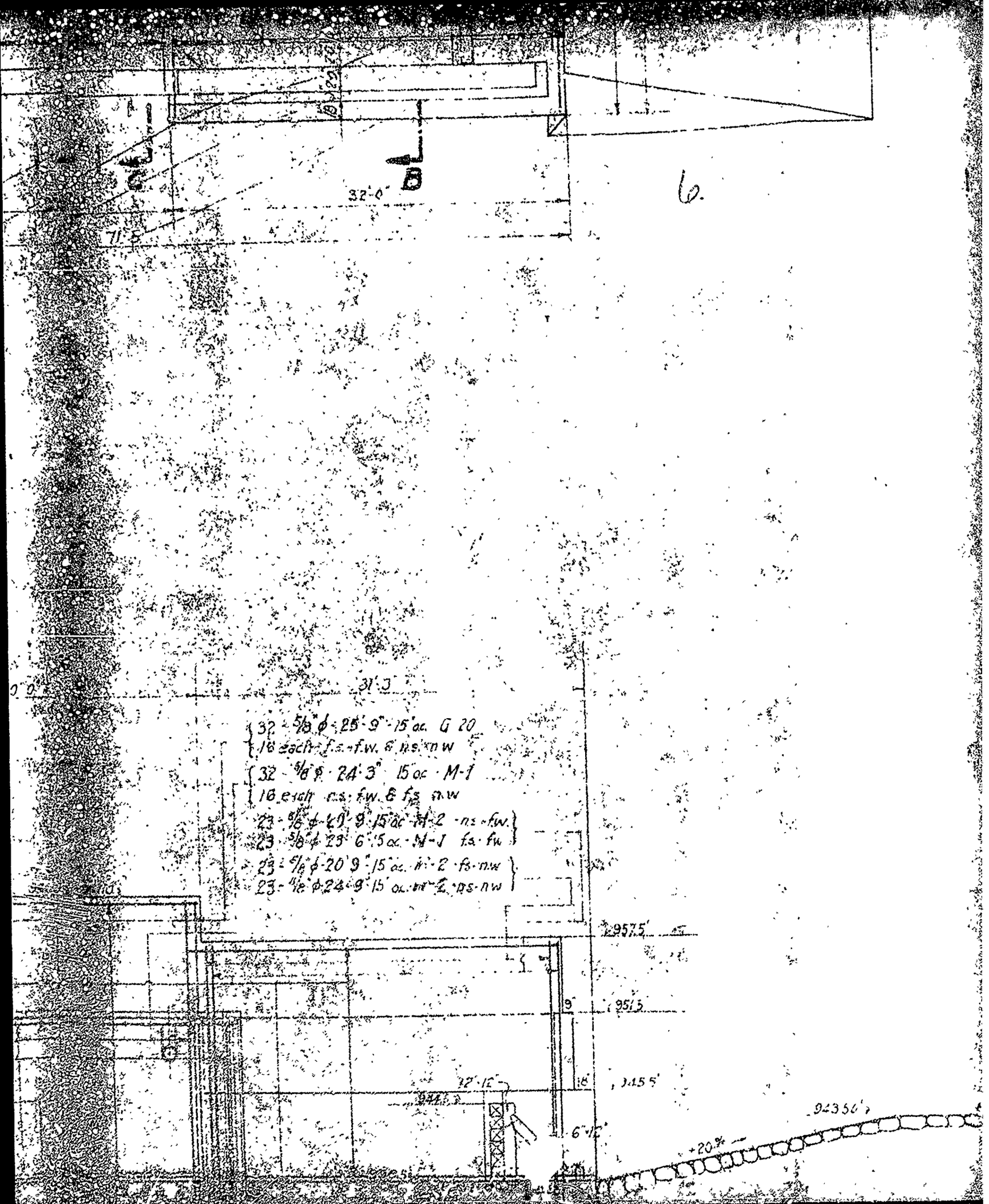
8'-0" 7'-0" 20'-0" 20'-0"

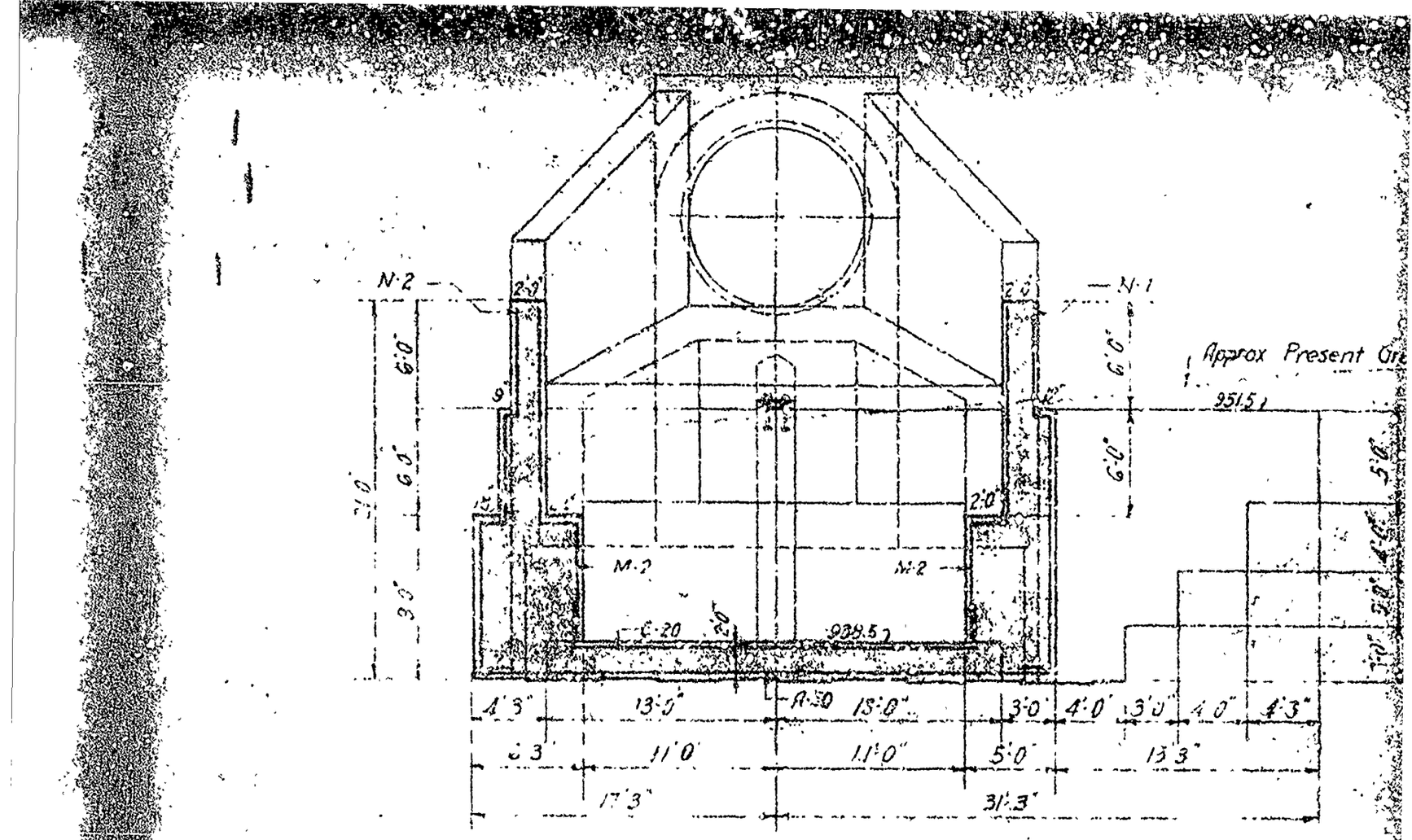
R 20 1/2 V.C. 2'-0"

970.21

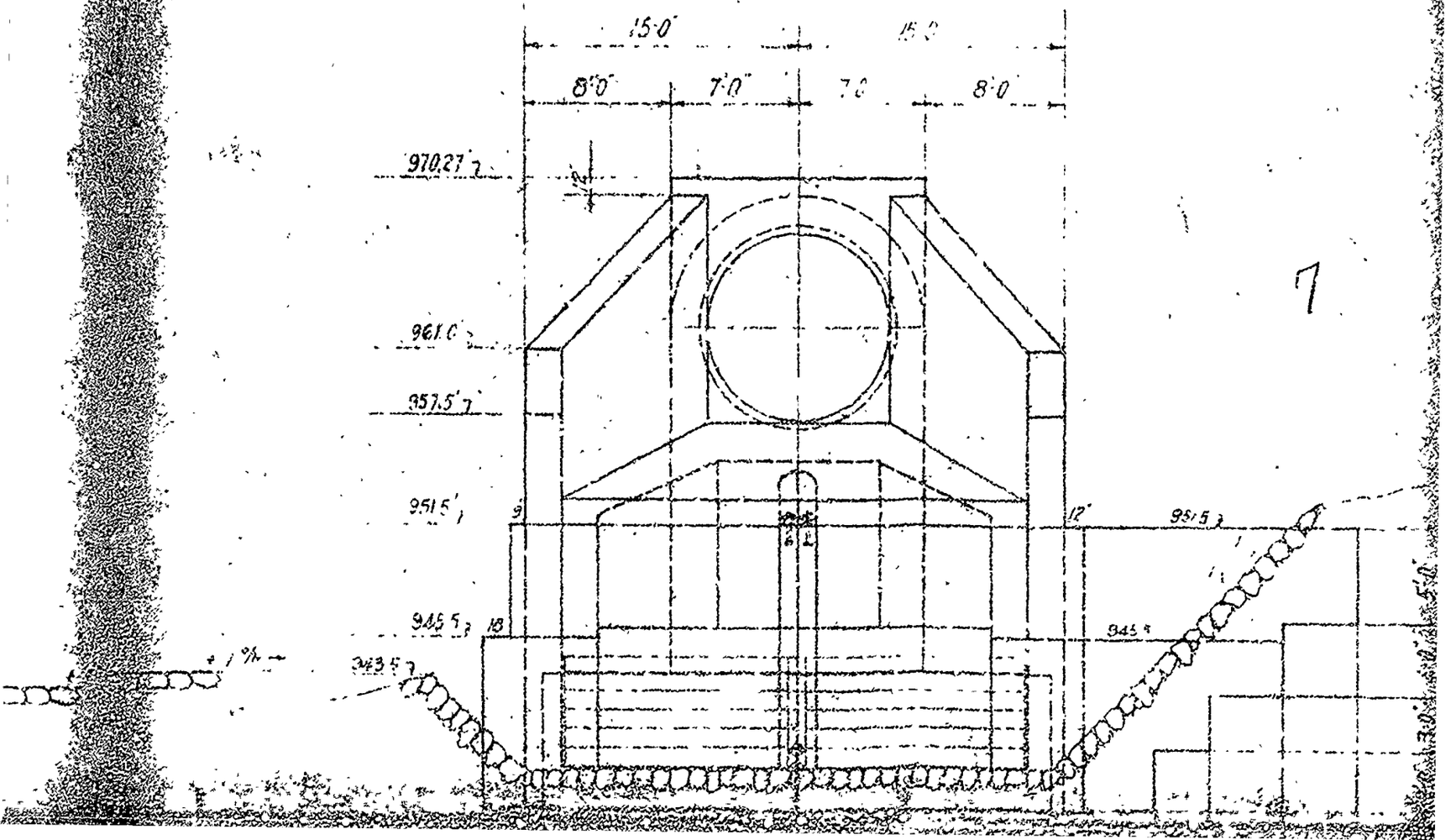
Carry Longitudinal Spacers 3'-0" through construction joint.

32 - #8 @ Variable - 12 o.c., A-20-35


32'-0"
31'-3
32 - 5/8" ϕ - 25' 9" - 15" oc. G 20
16 each f.s. - f.w. & n.s. n.w
32 - 5/8" ϕ - 24' 3" 15 oc M-1
16 each n.s. f.w. & f.s. n.w
23 - 5/8" ϕ - 40' 9" 15" oc M-2 - n.s. - f.w.
23 - 5/8" ϕ 23' 6" 15 oc. M-3 f.s. f.w.
23 - 5/8" ϕ 20' 9" 15" oc. M-2 - f.s. - n.w
23 - 5/8" ϕ 24' 9" 15" oc. M-2 - n.s. - n.w
957.5'
95'5
12'-12"
94'5
6"
+20%
92350'

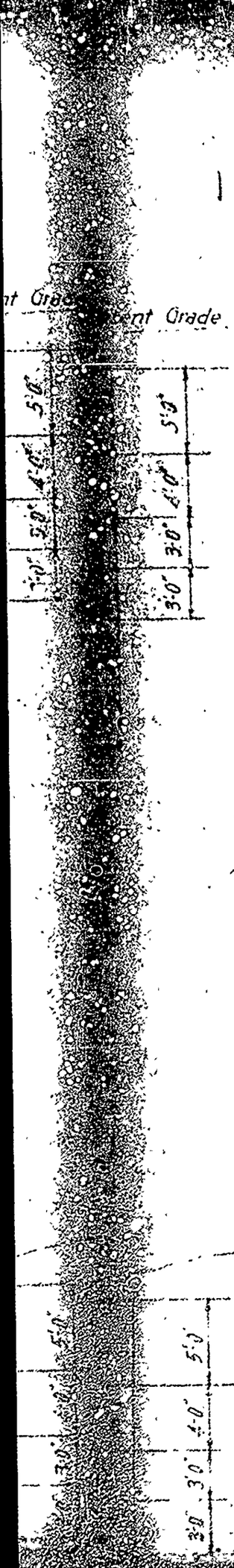

N-2
N-1
Approx Present Gr
951.5
939.5
6'0"
6'0"
2'0"
M-2
M-2
C-20
A-30
4'3"
13'0"
15'0"
3'0"
4'0"
3'0"
4'0"
4'3"
11'0"
11'0"
5'0"
15'3"
17'3"
31'3"

"B-B"


15'0"
8'0"
7'0"
8'0"
970.27
961.0
957.5
951.5
945.5
943.5
945.5
951.5
9
12
18
5'0"

7

8



Notes:-

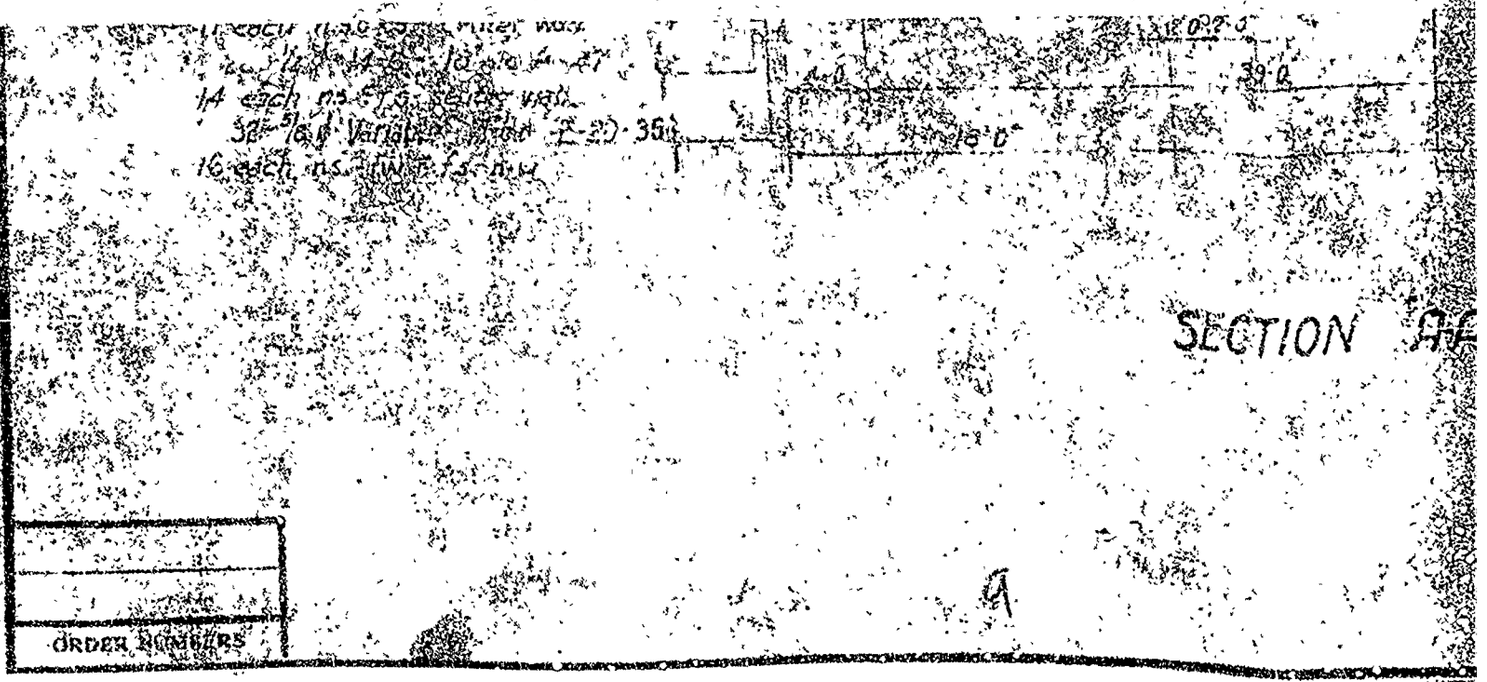
Concrete Mix 1:2:4 (2000#)

All Reinforcement to be 3" from face of forms

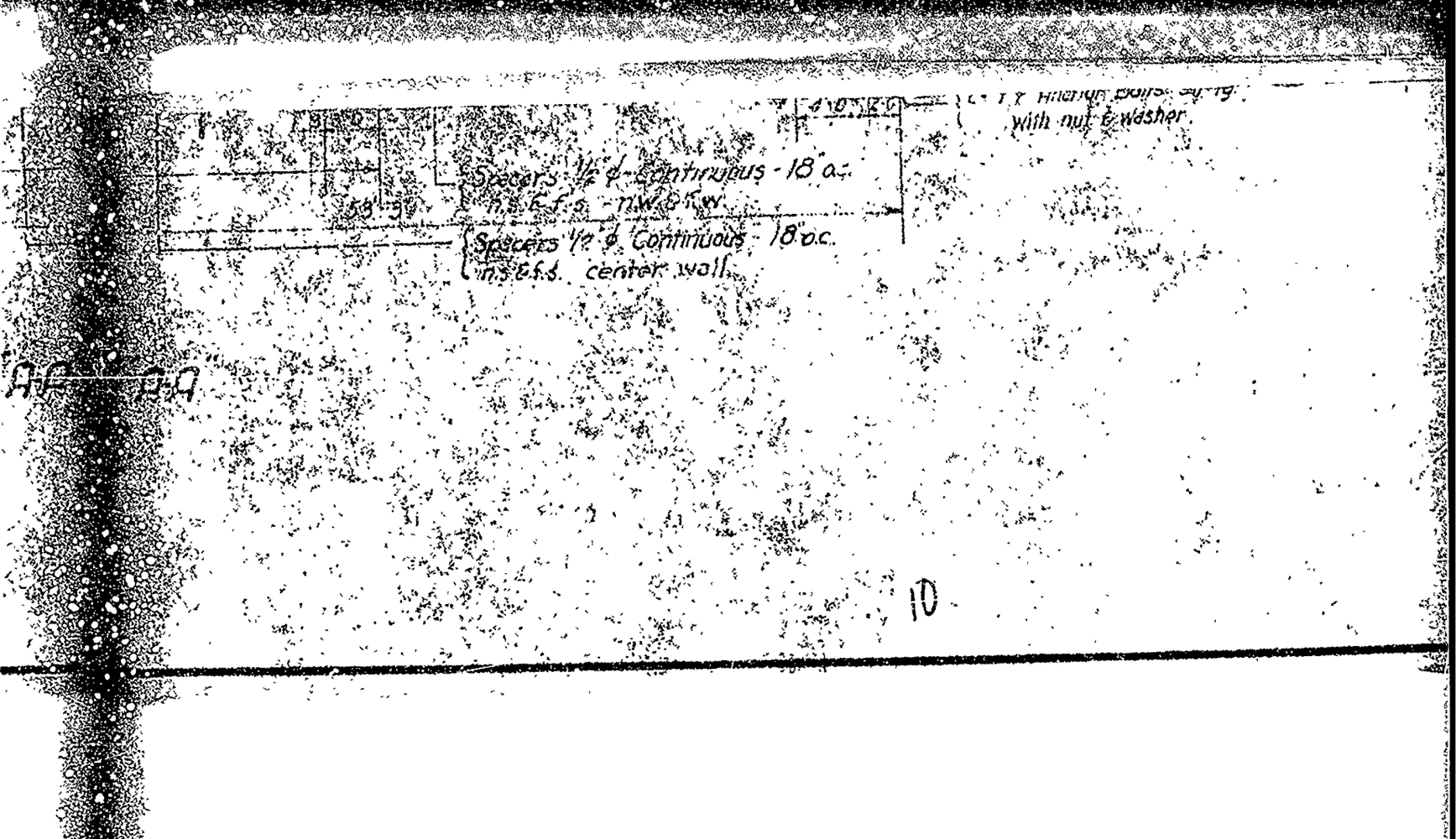
For General Location & Connecting Structures see Drawings KK-3-17, KK-3-26 & KK-3-28

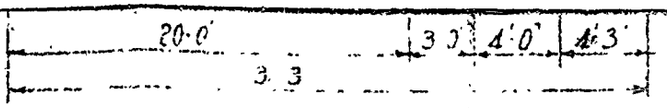
APPROVED:-

CHAS. T. MAIN, CONSULTING ENGR.



ORDER NUMBERS


Spacers ½" ϕ Continuous - 18" o.c.
n.s. E.f.s. - n.w. & f.w.
58'-9"
Spacers ½" ϕ Continuous - 18" o.c.
n.s. E.f.s. center wall
With nut & washer.
10



DOWNSTREAM ELEVATION

CA

REV

200 DEVONSHIRE ST
BOSTON MASS.
BY

CATSKILL POWER CORP. MIDDLETOWN, N.Y.

REVISIONS	

SWINGING BRIDGE DEVELOPMENT CONDUIT OUTLET

PREPARED BY CHARLES H TENNEY & CO.
ENGINEERS —— BOSTON, MASS.

Drawn	Traced	Checked
RDM	OKCB	

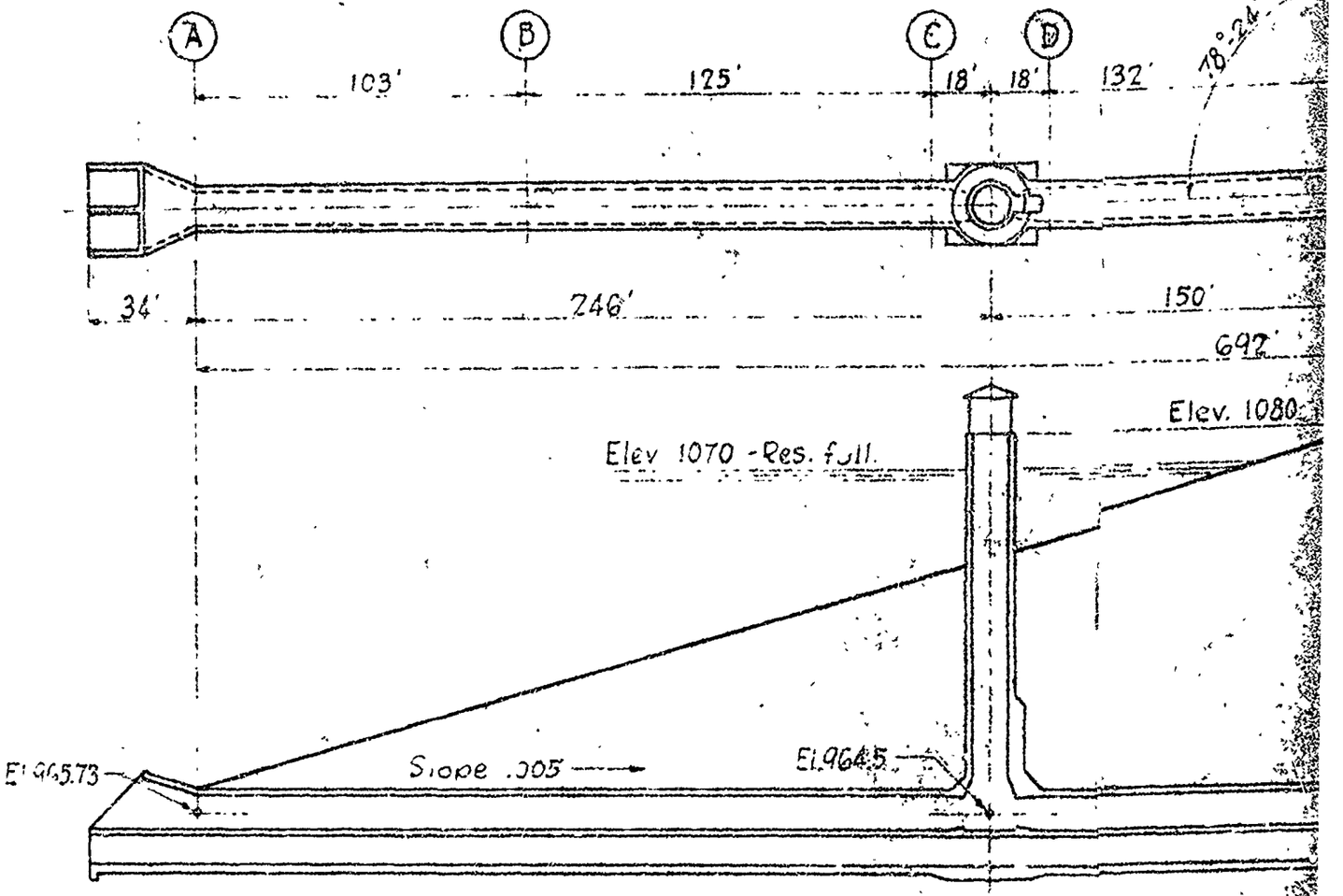
Examined

Asst. Engineer

Approved

SCALES			Oct. 1925	KK	3	27
1/8" - 1'-0"						

(25 X 33)

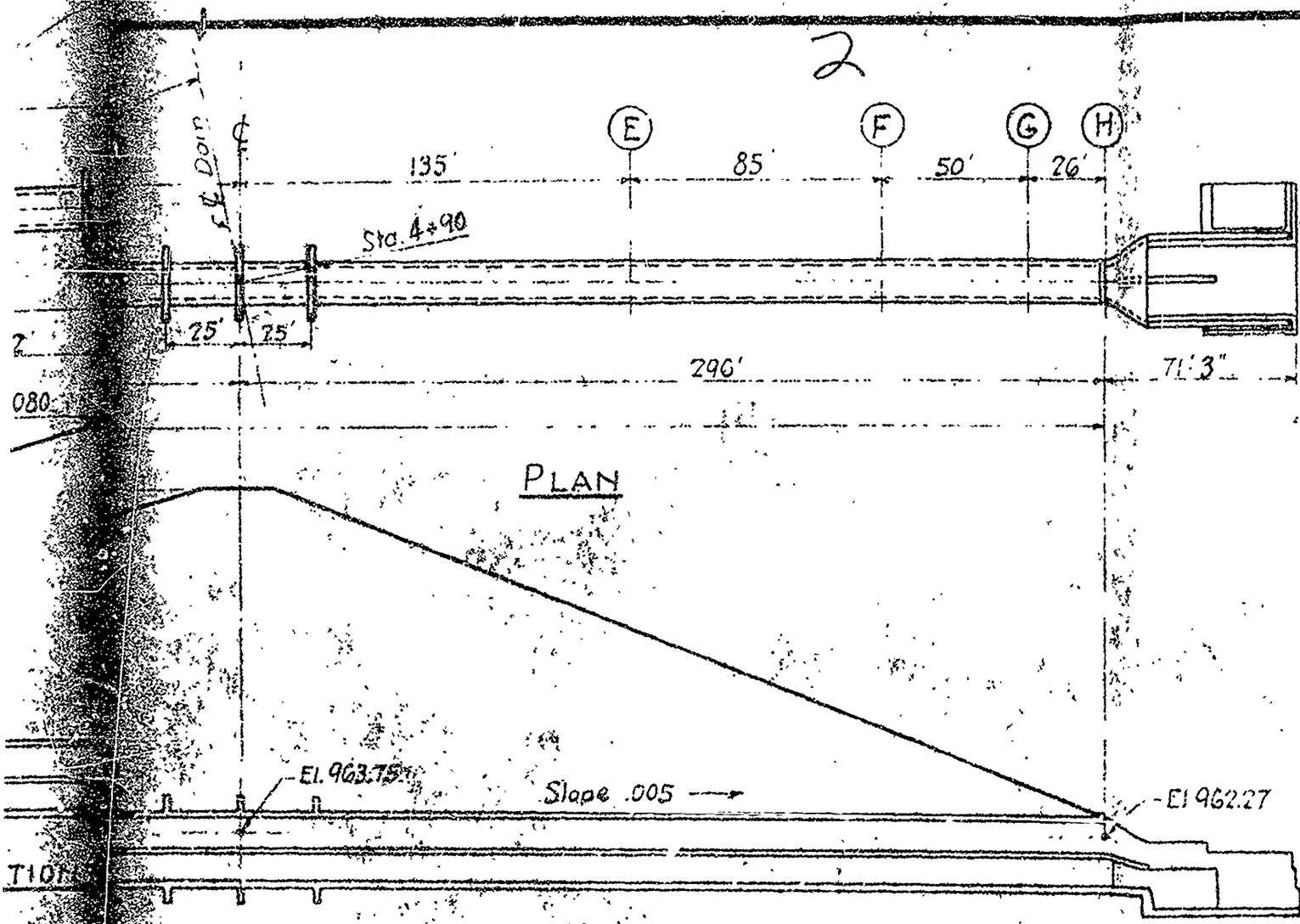


SECTIO

SCH

DIAGRAM	MARK	NO. REQ'D	SIZE	LENGTH
LENGTH	A1	45	1"φ	4'-3"
	A2	128	1"φ	7'-0"
	A3	41	1"□	13'-9"
	A4	36	1"φ	14'-4"
	A5	96	1"φ	11'-6"
	A6	70	1"φ	16'-0"
	A7	18	1"φ	23'-9"
	A8	13	"φ	18'-0"
	A9	56	"φ	10'-9"
	A10	42	1"φ	10'-0"
7:3 / 2'-0"	G1	18	1"φ	9'-3"
7'-0" / 2'-0"	G2	20	7/8"φ	9'-0"

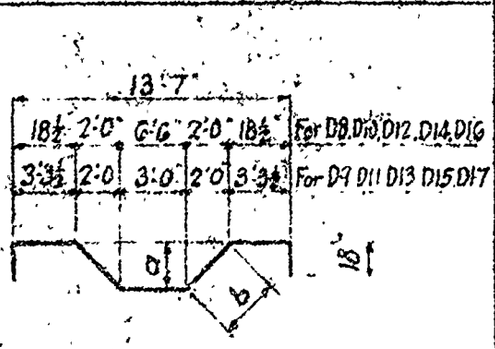
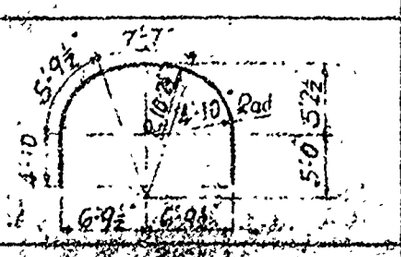
DIAGRAM	MARK	NO. REQ'D	SIZE	LENGTH
4'-10" / D / a a	B1	2	1"φ	30'-0"
	B2	2	1"φ	26'-0"
	B4	2	1"φ	25'-5"
	B5	2	1"φ	25'-3"
	B6	2	1"φ	25'-1"
	B7	2	1"φ	24'-10"
	B8	2	1"φ	24'-8"
	B9	2	1"φ	24'-5"
	B10	2	1"φ	24'-3"
	B11	2	1"φ	24'-1"
	B12	2	1"φ	23'-11"
5'-9" / D / R / a	B5	4	1"φ	20'-8"
	B6	4	1"φ	22'-7"
	C1	35	1"φ	46'-7"



ON ℄ OF CONDUIT

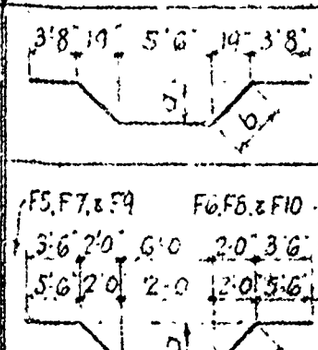
SCALE - 1" = 50'

SCHEDULE OF REINFORCEMENT

a	b	DIAGRAM
		
8'-9½"	14'-11"	
9'-7½"	16'-10"	

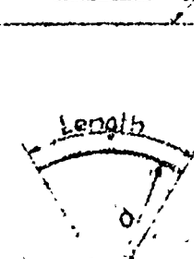
MARK	NO REQ'D	SIZE	LENGTH	a	b
D8	2	1"φ	18'-6"	2'-2"	2'-11½"
D9	2	1"φ	18'-7"	2'-3"	3'-0"
D10	2	1"φ	18'-10"	2'-5"	3'-1½"
D11	2	1"φ	18'-11"	2'-8"	3'-2"
D12	2	1"φ	19'-3"	2'-8"	3'-4"
D13	2	1"φ	19'-4½"	2'-9"	3'-4½"
D14	2	1"φ	19'-8"	2'-11"	3'-6½"
D15	2	1"φ	19'-9½"	3'-0"	3'-7½"
D16	2	1"φ	20'-1"	3'-2"	3'-9"
D17	2	1"φ	20'-2½"	3'-3"	3'-9½"
B3	12	1"φ	28'-10"		

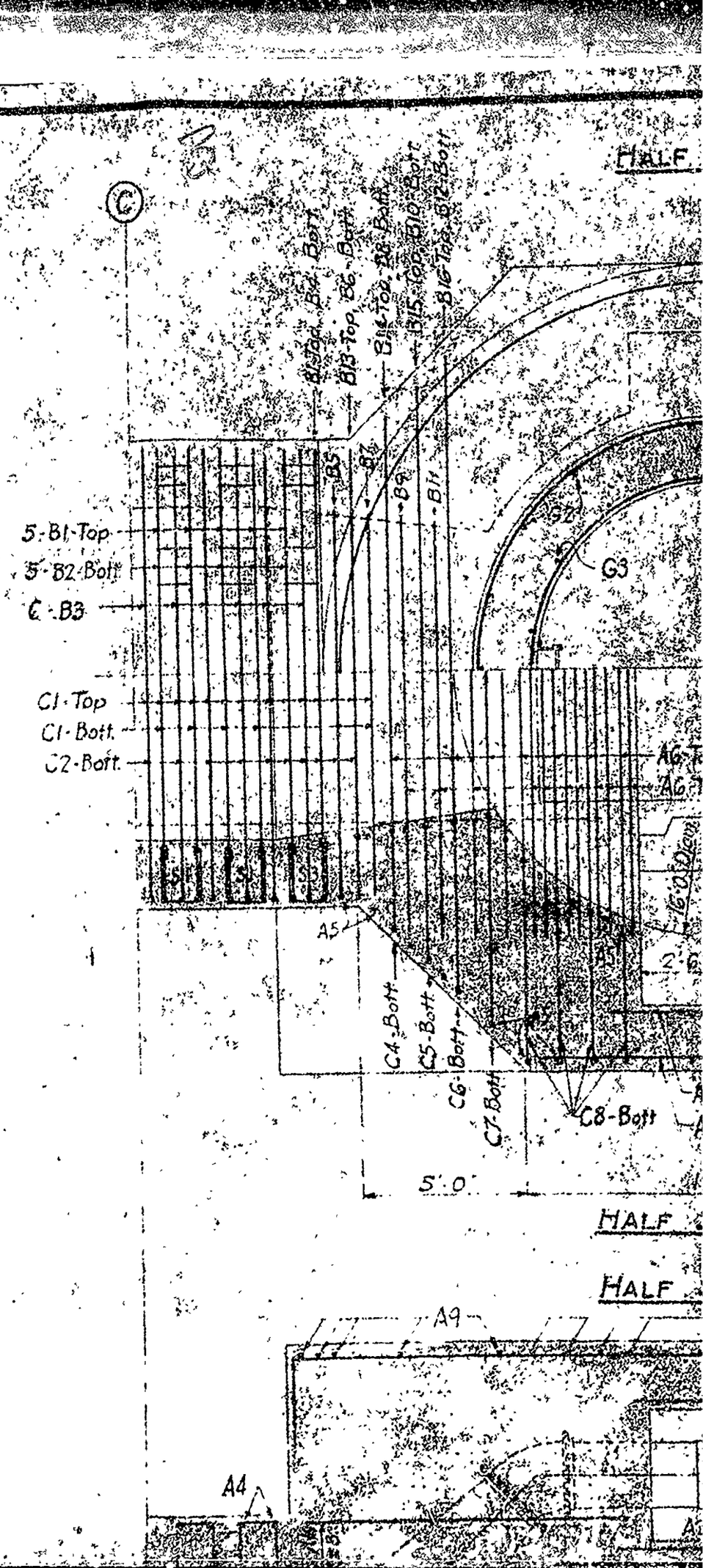
DIAGRAM



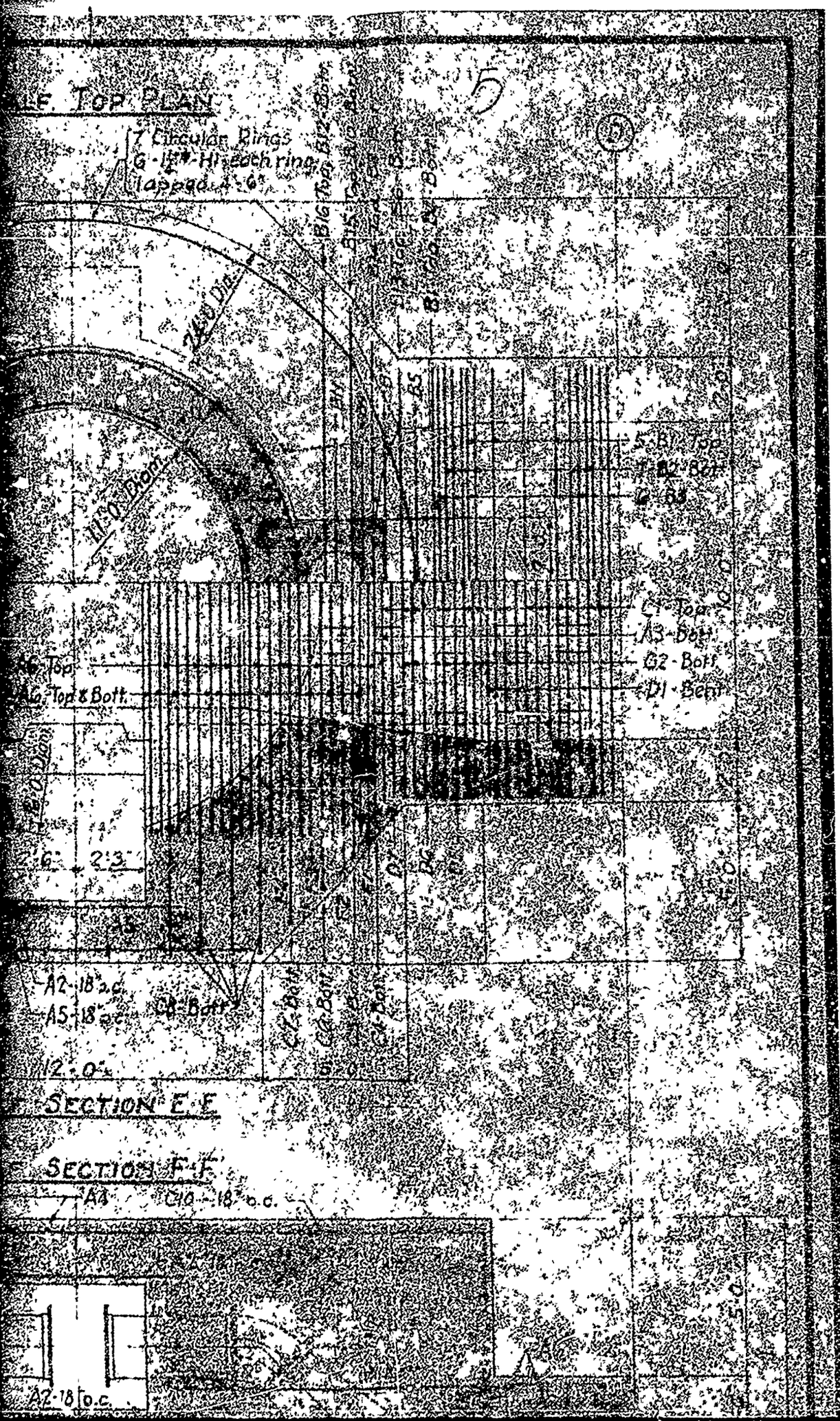
MARK

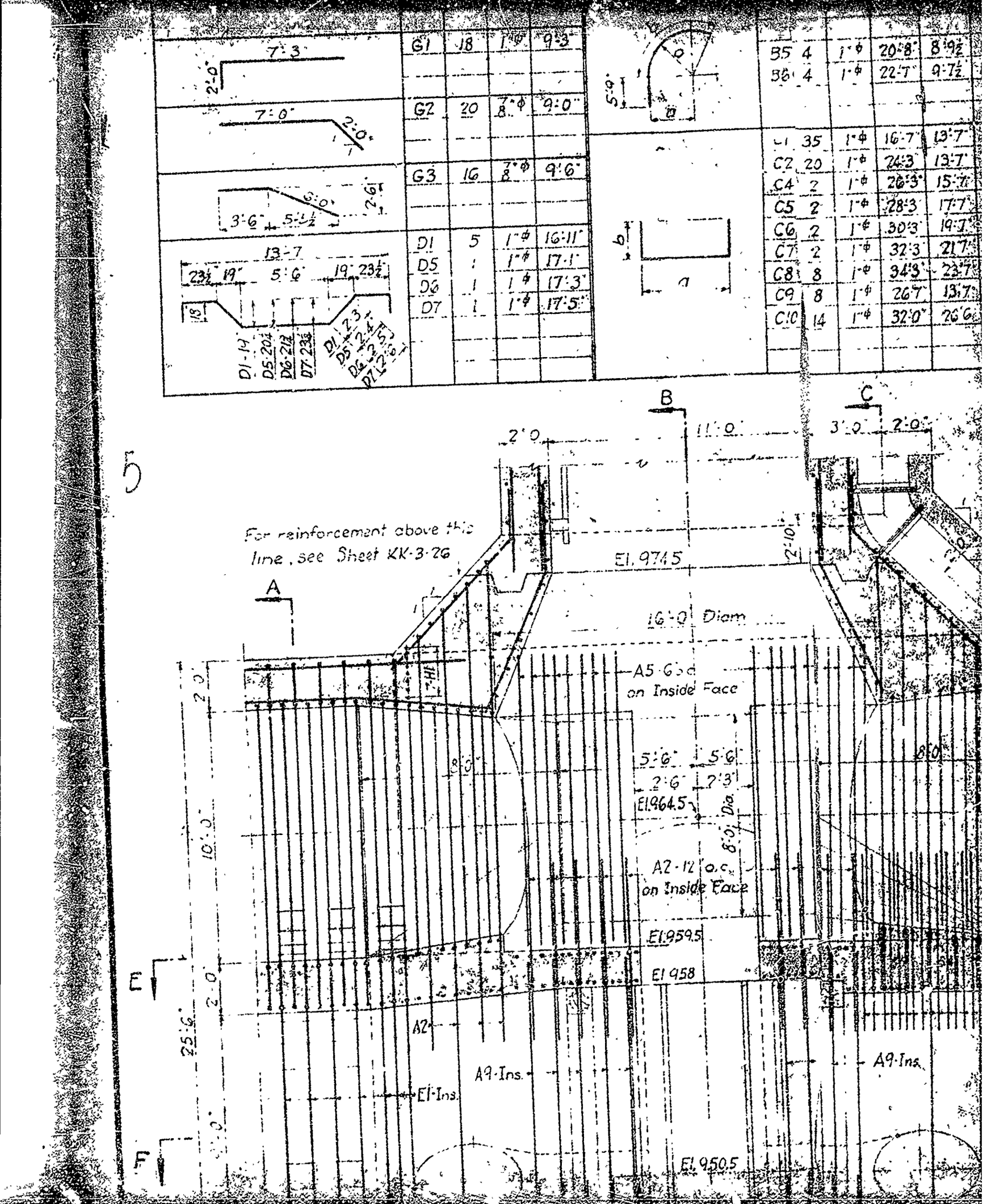
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
H1
H2
H3
H4
H5
H6





MARK						
F1		MARK	NO. REQ'D	SIZE	LENGTH	a	b
F2		F1	1	1"ϕ	18'-0½"	2'-0¾"	2'-7¼"
F3		F2	1	1"ϕ	18'-3"	2'-2¼"	2'-8½"
F4		F3	1	1"ϕ	18'-5½"	2'-3¾"	2'-9¾"
F5		F4	1	1"ϕ	17'-4"	19"	2'-3"
F6		F5	2	1"ϕ	20'-11"	3'-5"	3'-11½"
F7		F6	2	1"ϕ	21'-1"	3'-6"	4'-0½"
F8		F7	11	1"ϕ	21'-2½"	3'-7"	4'-1¼"
F9		F8	11	1"ϕ	21'-2½"	3'-7"	4'-1¼"
F10		F9	13	1"ϕ	18'-7"	2'-9½"	3'-1"
H1		F10	13	1"ϕ	18'-7"	2'-9½"	
H2		H1	42	1½"ϕ	16'-6"	11'-6"	
H3		H2	6	¾"ϕ	13'-6"	10'-6"	
H4		H3	6	¾"ϕ	12'-6"	9'-6"	
H5		H4	6	¾"ϕ	11'-6"	8'-6"	
H6		H5	4	¾"ϕ	15'-0"	8'-0"	
		H6	4	¾"ϕ	14'-3"	7'-6"	

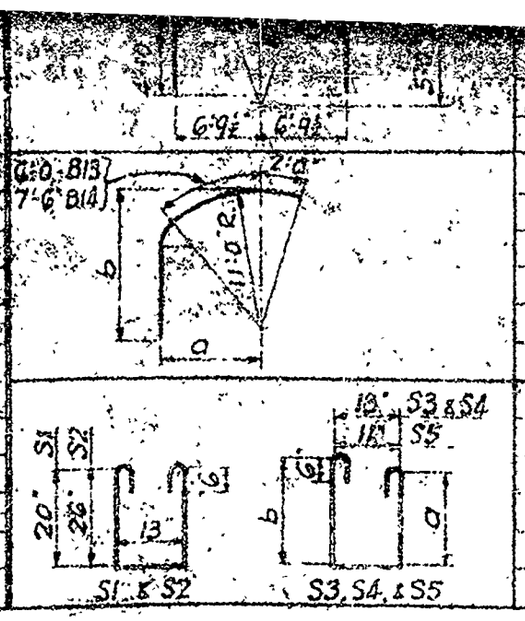

LE TOP PLAN
7 Circular Rings
G - 1" ϕ - HI each ring
lapped 4'-6"
11'-0" Diam
11'-0" Diam
B6 Top
A6 Top & Bott
2'-6"
2'-3"
A2 - 18" c.c.
A5 - 18" c.c.
C8 - Bott
12'-0"
SECTION E-E
SECTION F-F
A4
C10 - 18" c.c.
A2 - 18" c.c.
5 - B1 Top
7 - B2 Bott
6 - B3
C1 - Top
A3 - Bott
C2 - Bott
D1 - Bott



G1	18	1" ϕ	9'-3"
G2	20	⅞" ϕ	9'-0"
G3	16	⅞" ϕ	9'-6"
D1	5	1" ϕ	16'-11"
D5	1	1" ϕ	17'-1"
D6	1	1" ϕ	17'-3"
D7	1	1" ϕ	17'-5"

B5	4	1" ϕ	20'-8"	8'-9½"
B6	4	1" ϕ	22'-7"	9'-7½"
C1	35	1" ϕ	16'-7"	13'-7"
C2	20	1" ϕ	24'-3"	13'-7"
C4	2	1" ϕ	26'-3"	15'-7"
C5	2	1" ϕ	28'-3"	17'-7"
C6	2	1" ϕ	30'-3"	19'-7"
C7	2	1" ϕ	32'-3"	21'-7"
C8	8	1" ϕ	34'-3"	23'-7"
C9	8	1" ϕ	26'-7"	13'-7"
C10	14	1" ϕ	32'-0"	26'-6"

9½			8'-9½"	15'-11"					
7½	16		9'-7½"	16'-10"					
7"		7"	13'-7"	18"	B13	A	1" ϕ	19'-1"	6'-9½"	12'-6"
7"	5	3"	13'-7"	5'-4"	B14	4	1" ϕ	20'-8"	7'-7½"	13'-6"
7"	5	3"	15'-7"	5'-4"						
7"	5	3"	17'-7"	5'-4"						
7"	5	3"	19'-7"	5'-4"						
7"	5	3"	21'-7"	5'-4"						
3'-7"	5	3"	23'-7"	5'-4"	S1	60	⅝" ϕ	5'-10"		
3'-7"	2	7"	13'-7"	6'-6"	S2	64	⅝" ϕ	6'-10"		
6'-6"	2	0"	26'-6"	2'-9"	S3	30	⅝" ϕ	6'-1"	20¾"	22¼"
					S4	6	⅝" ϕ	6'-7"	23¾"	25¼"
					S5	6	⅝" ϕ	7'-0¾"	26½"	28"



Longitudinals and Spacers

Note:- All reinforcement

H4	6	¾ ϕ	11'6"	8'6"
H5	4	¾ ϕ	15'0"	8'0"
H6	4	¾ ϕ	14'3"	7'6"
H7	4	¾ ϕ	13'6"	7'0"
H8	4	¾ ϕ	12'9"	6'6"
H9	4	¾ ϕ	12'0"	6'0"
Longit' walings	1	⅞ ϕ	18'0"	
Spacers		½ ϕ		

...dinals and ...pacers

These include longitudinals and spacers not shown on drawing, to be used as required.

...einforcement to be deformed rods

7

A9 - 18" o.c.

F8 - 12" o.c.

E7 - 12" o.c.

A3 - Top - 12 o.c. from Ⓒ to Ⓓ

B8 - Bott.

D8 D9 D10 D11 D12 D13 D14 D15 D16

...ϕ ... B13 to B16

13'-6"

⅞ ϕ Longit Rods Lapped 3'-0"

El 971.5

A5 1" ϕ - 12" o.c

El 959.5

A9

A9

A16

B1 - 12" o.c. B1 - 12" o.c.

B2 - 12" o.c. B2 - 12 o.c.

B3 - 12 o.c.

⅝ ϕ S1

10'-0"

2 C1 per ft.

D1 - 12 o.c.

C1 - 6 o.c.

A3 - 12 o.c.

C1 - 12 o.c.

C2 - 12 o.c.

C2 - 12 o.c.

E1 - 12 o.c.

A6 - 12 o.c.

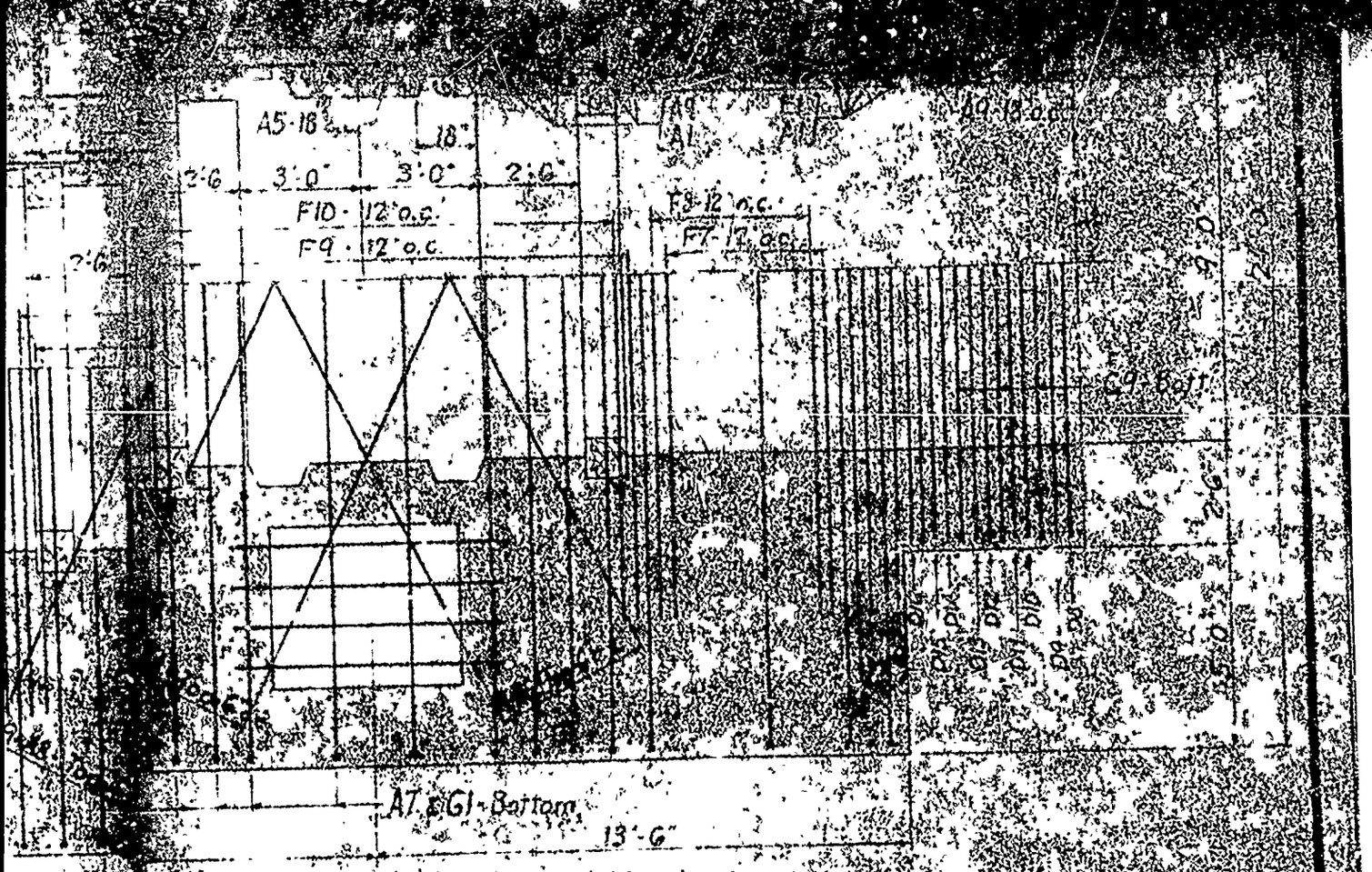
A4 - 12 o.c.

A1 - 12 o.c.

A3

27'-6"

2 - A2 per ft.



HALF BOTTOM PLAN

NOTES

Concrete Mix - 1:2:4

Concrete to be poured continuously between construction joints.

All construction joints to be keyed, and cleaned and slushed with 1:2 portland cement before concrete is poured.

All longitudinal rods to be $\frac{7}{8}$" ϕ with 3'-0" lap except as shown.

Spacers not shown on drawings to be $\frac{1}{2}$" ϕ used as required.

REFERENCE DRAWINGS

KK-3-21 GATE TOWER

KK-3-22 GATE TOWER - TEMPORARY GATES

KK-3-23 " " STEEL DETAILS - SHEET 1

KK-3-24 " "

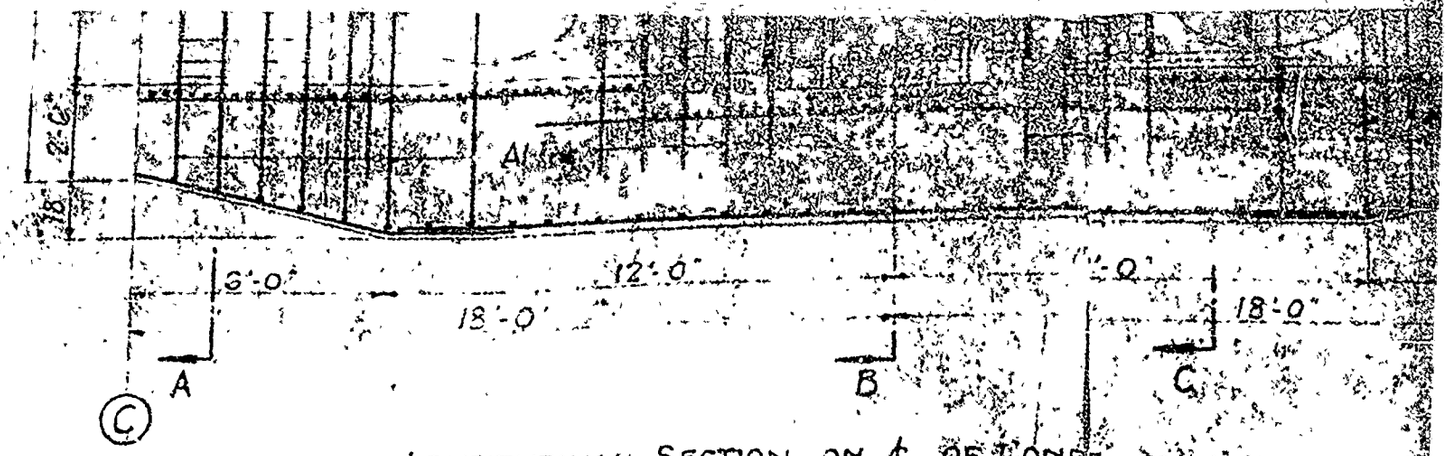
KK-3-26 CONDUIT - SHEET 2

APPROVED:-

CHAS. T. MAIN, CONSULTING ENG.

200 DEVONSHIRE ST.

BOSTON, MASS.

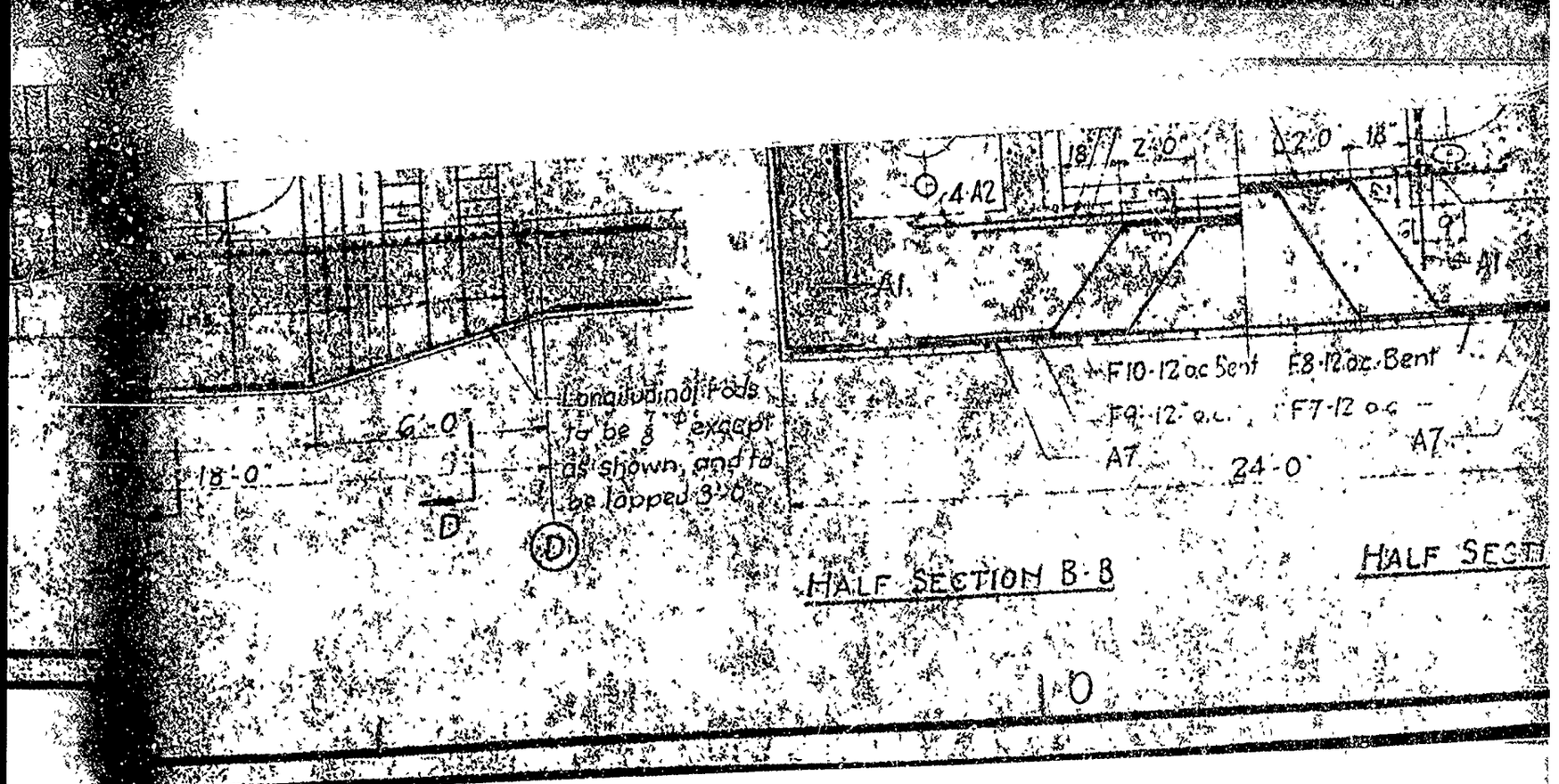


LONGITUDINAL SECTION ON ℄ OF CONDT

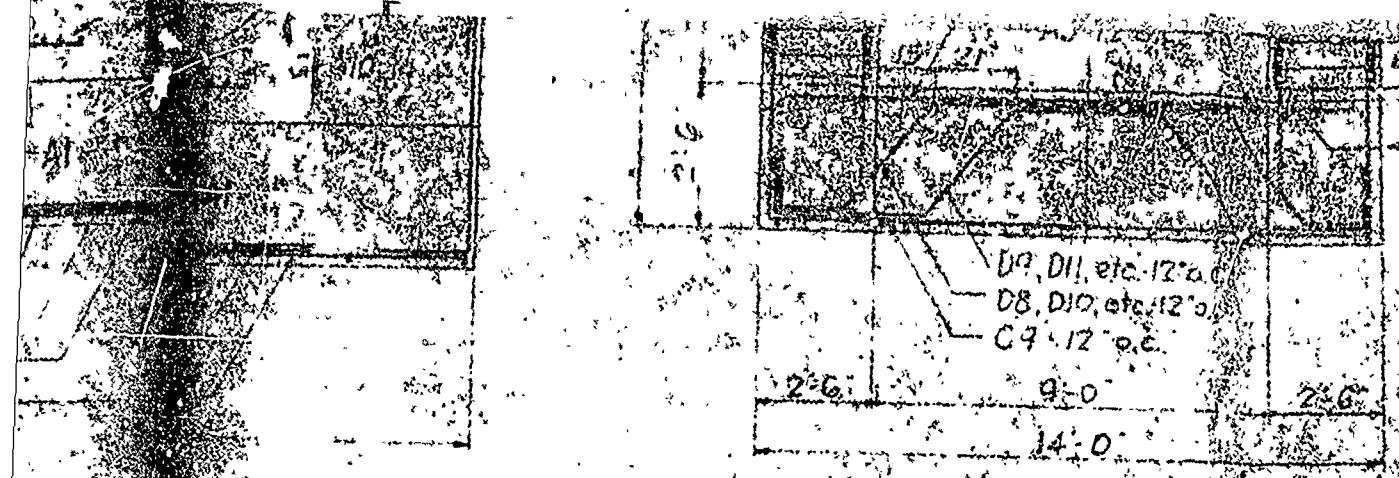
9

ORDER NUMBERS

7


4 A2
18"
2'-0"
2'-0"
18"
A1
F10-12 oc Bent
F8-12 oc Bent
F9-12 o.c.
F7-12 o.c.
A7
24'-0"
A7
6'-0"
18'-0"
B
Longitudinal rods
to be 8 " exept
as shown, and to
be lapped 3'-0"
HALF SECTION B-B
HALF SECTI

10



SECTION C-C

HALF SECTION D-D

HALF SECTION A-A

200 DEVONSHIRE ST.
BOSTON, MASS.

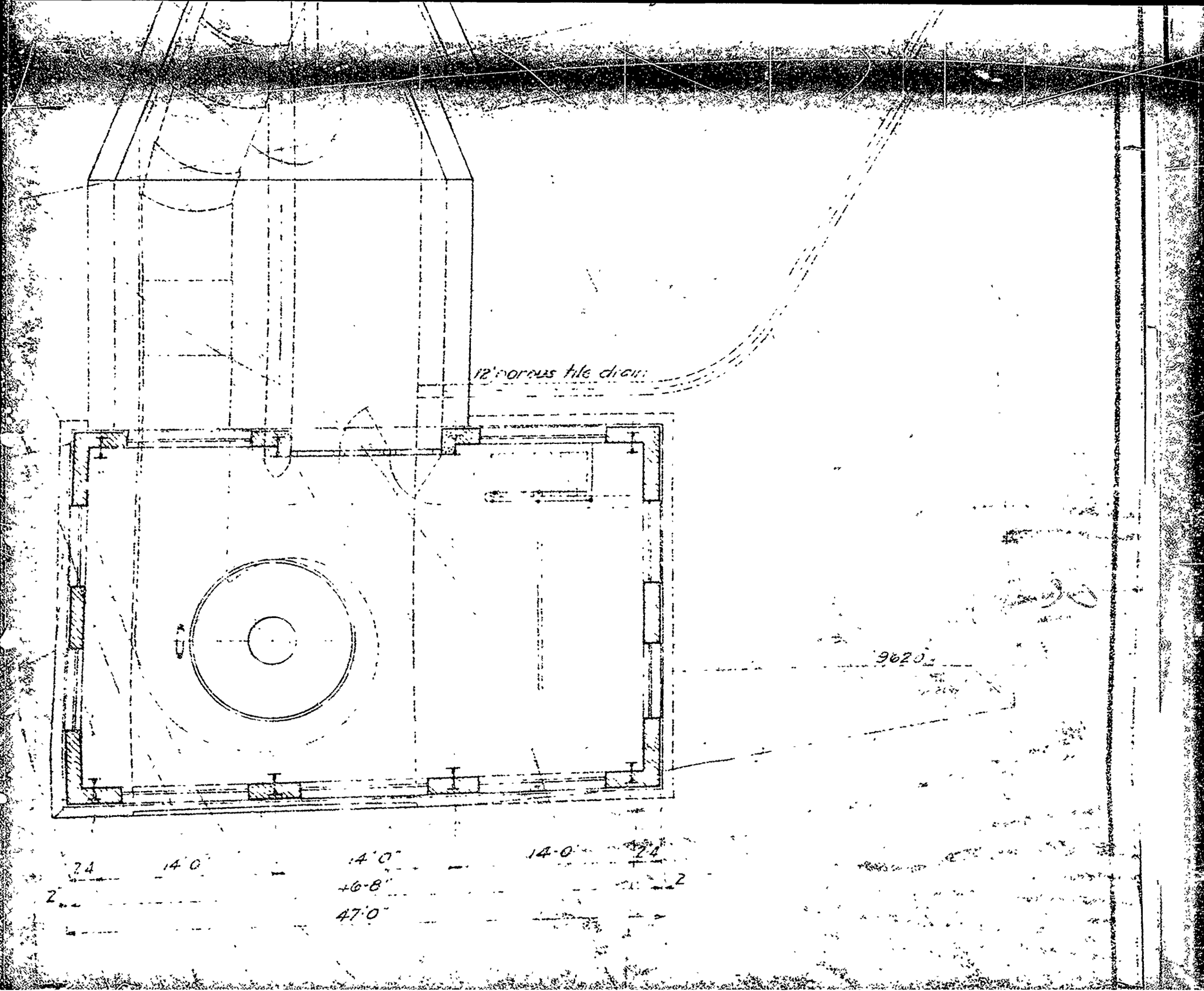
12

BY

CATSKILL POWER CORP. - MIDDLETOWN, N.Y.

REVISIONS		SWINGING BRIDGE DEVELOPMENT CONDUIT SHEET No. 1	Drawn LGR	Traced GR	Checked
			Approved		
		PREPARED BY CHARLES R. JENNEY & CO. ENGINEERS BOSTON, MASS.			
		SCALES 1/2" = 1'	DEC. 15, 1925	KK	3	25

Downstream Toe of Dam at Elev 962.2'


12" porous tile drain
9620
24
14'0"
14'0"
14-0"
24
+6-8"
47'0"

3

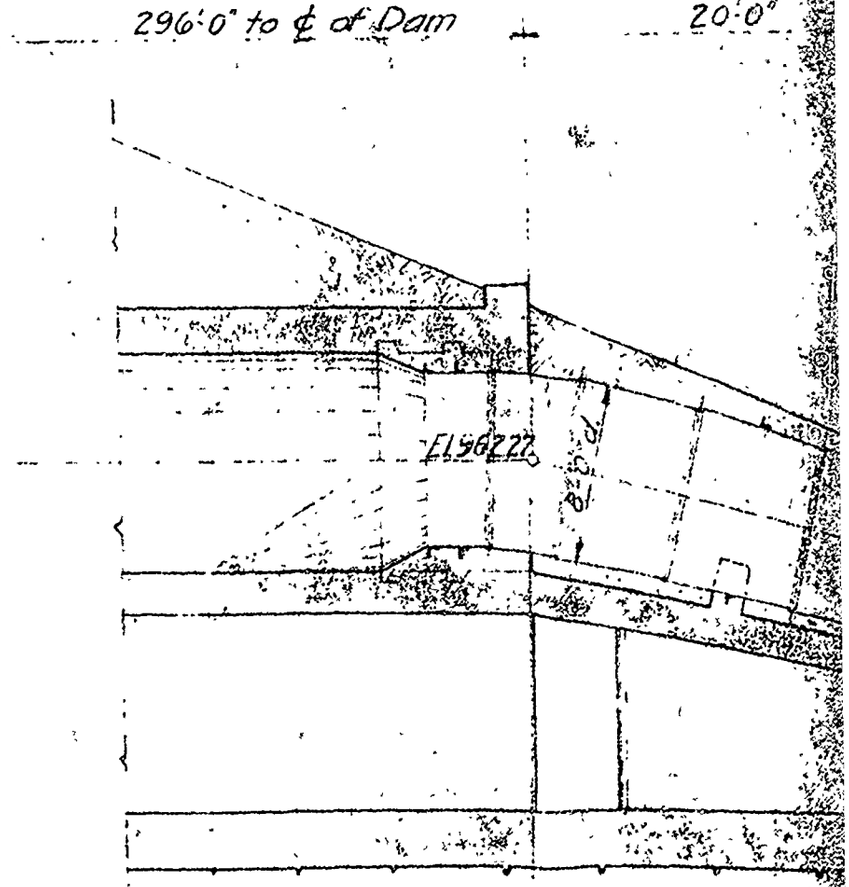
95°

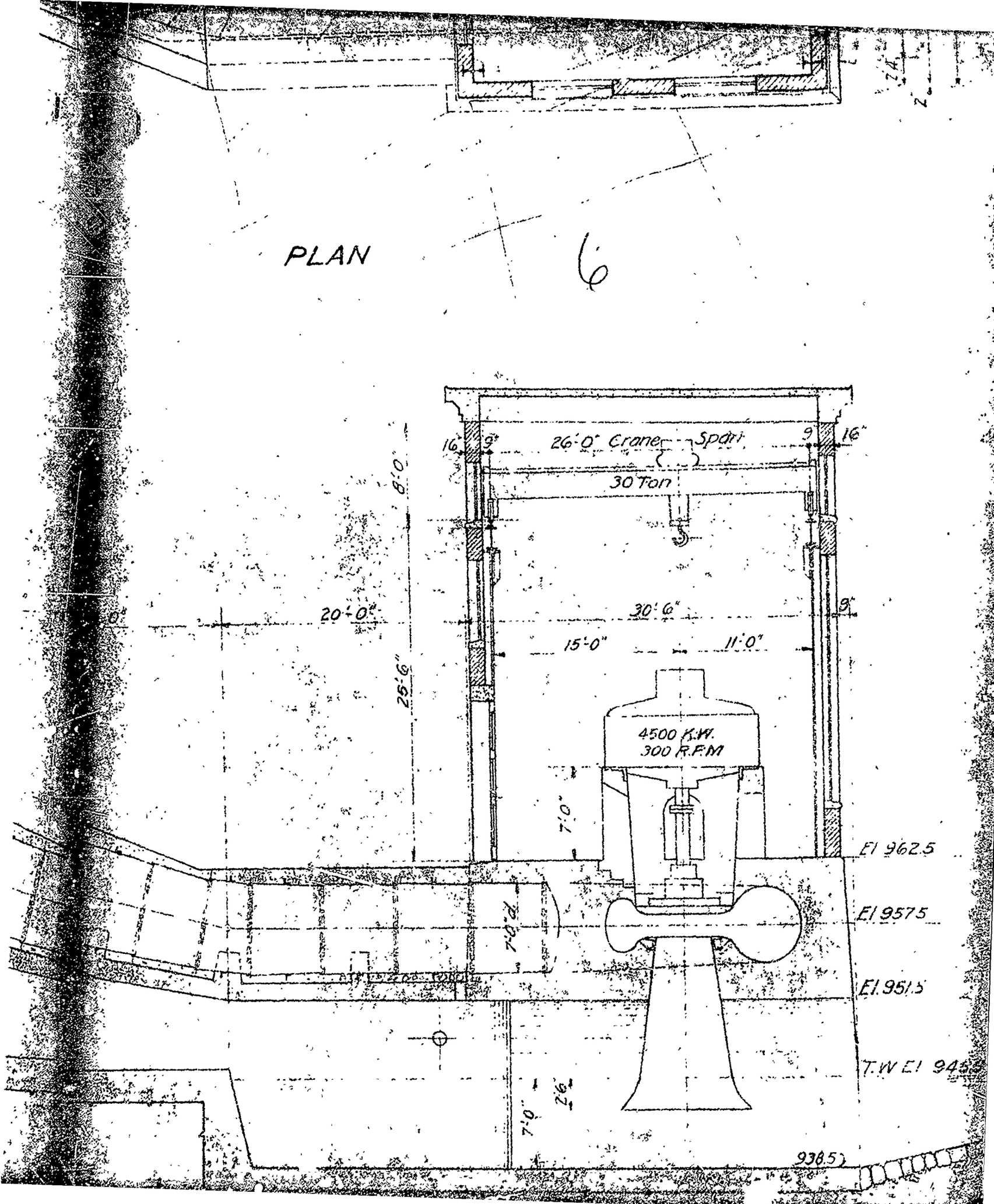
9435

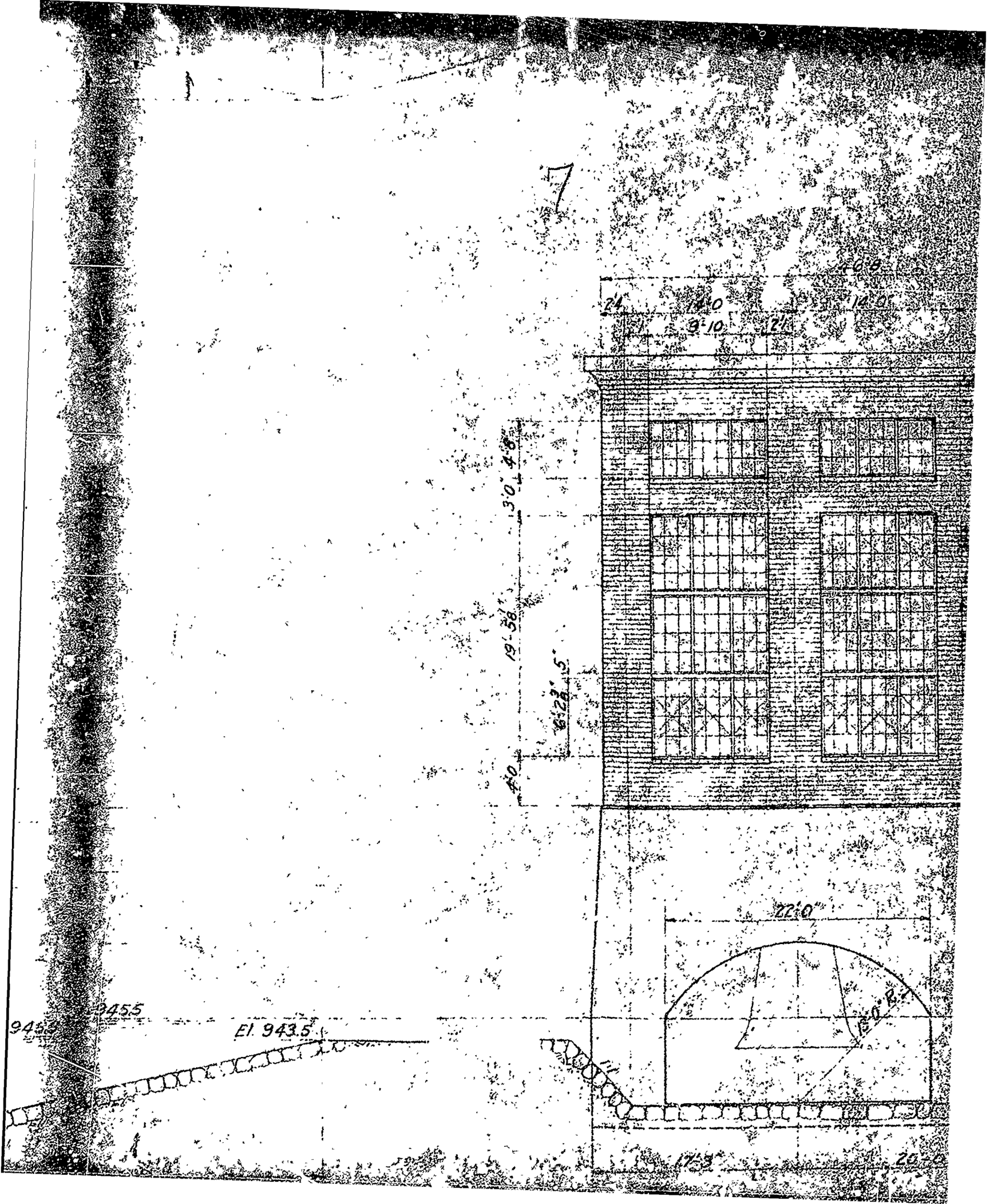
Present Rivers Edge

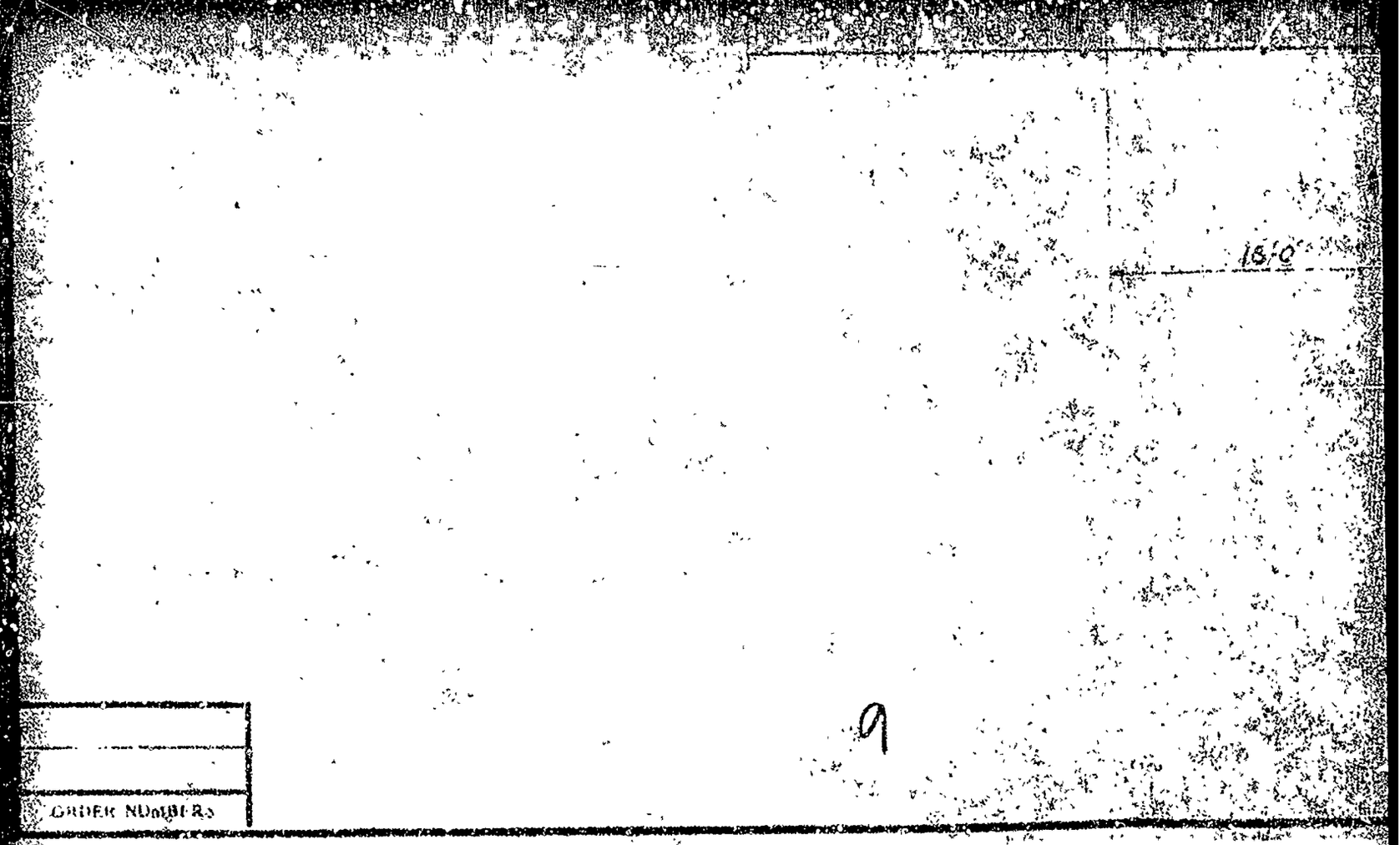
4

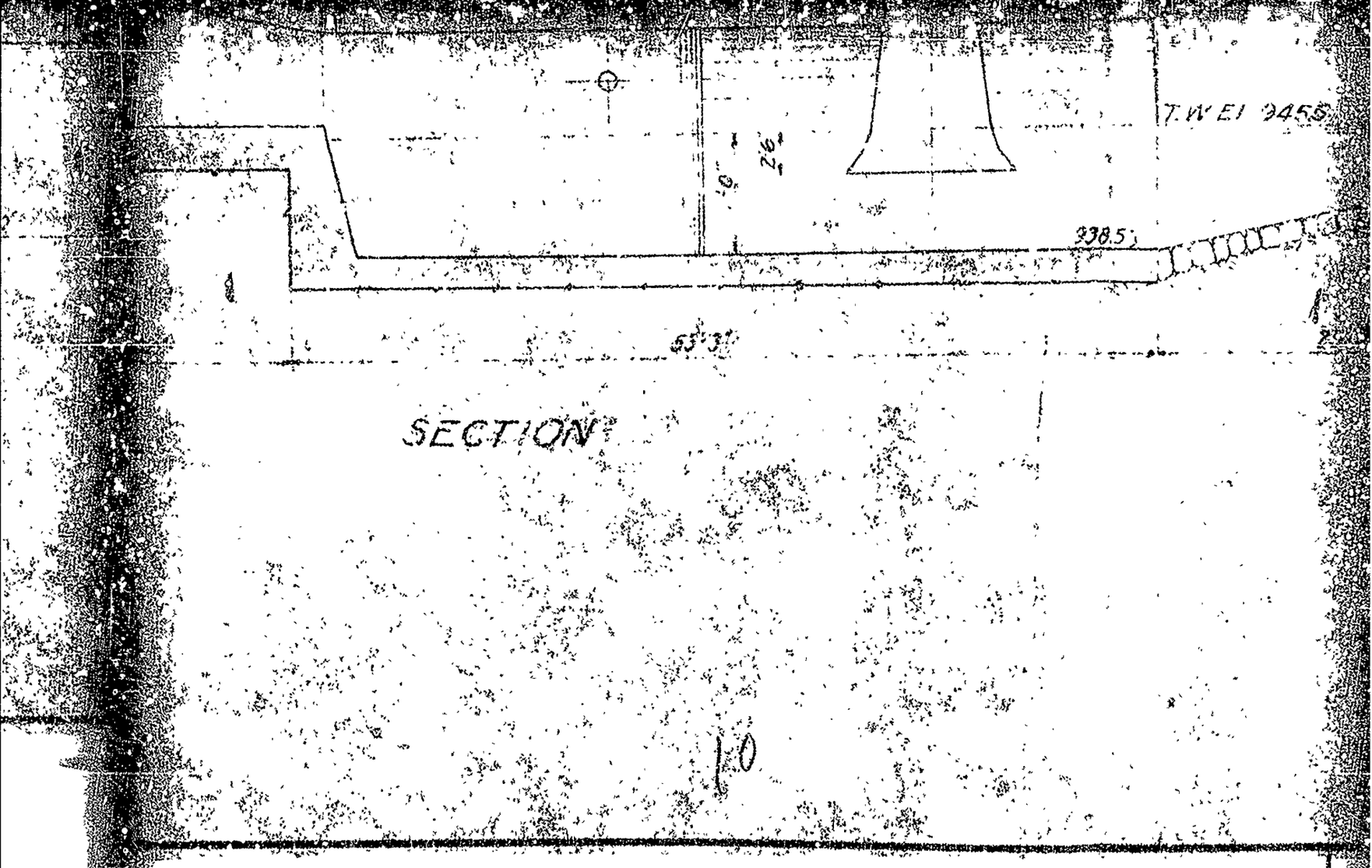
5




PLAN
6
16"
9"
26'-0" Crane Span
9"
16"
30 Ton
8'-0"
20'-0"
30'-6"
9"
15'-0"
11'-0"
25'-6"
4500 K.W.
300 R.P.M
7'-0"
El 962.5
7'-0"
El 9575
El 9515
T.W El 9455
2'-6"
7'-0"
938.5


14'-0"
14'-0"
9'-10"
12"
3'-0"
4'-8"
19'-3½"
6'-2½"
4'-0"
22'-0"
12'-0" R.
El. 943.5
17'-3"
20'-0"


18'-0"
9
ORDER NUMBERS



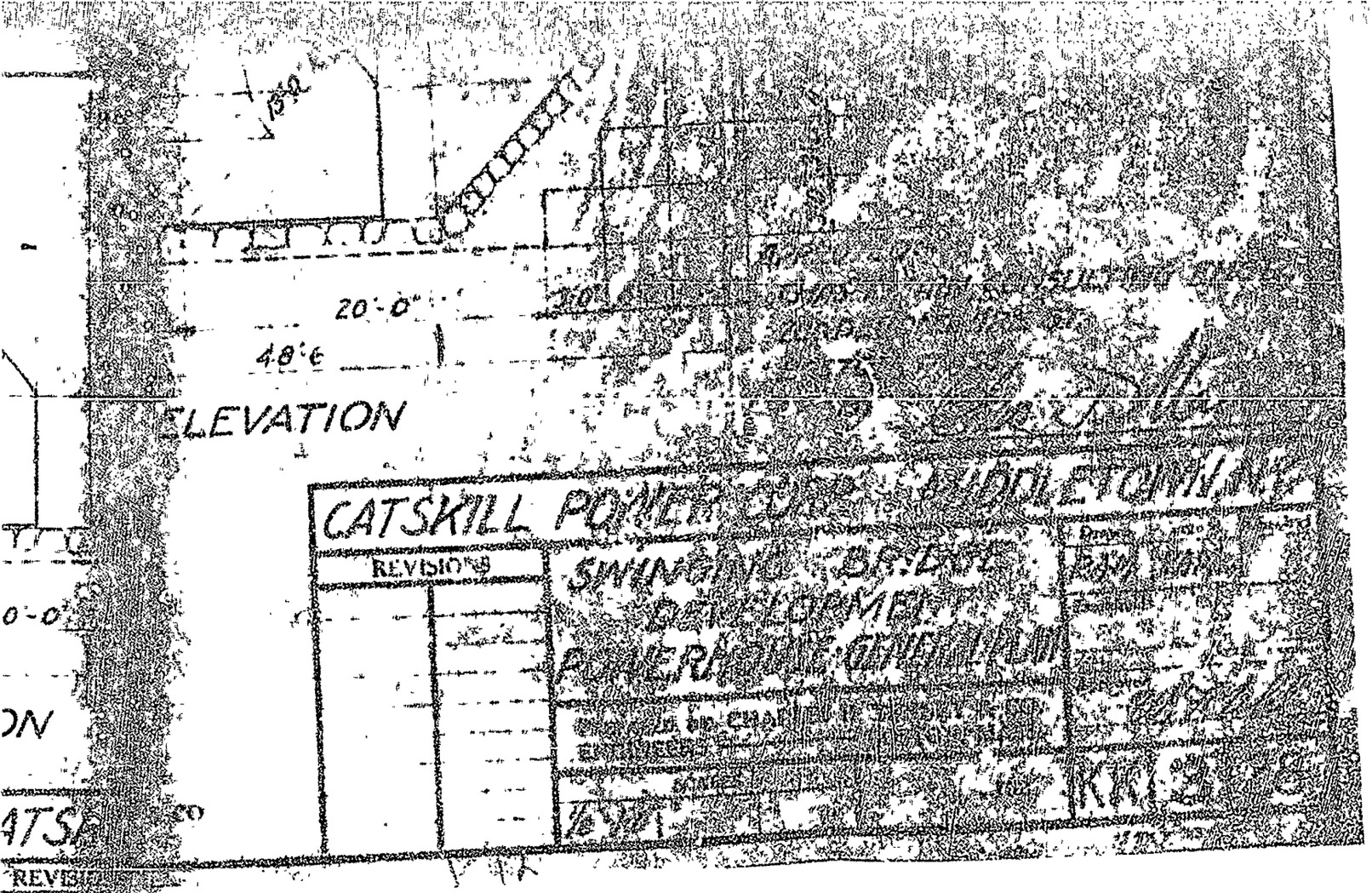
SECTION

10

ELEVATION

CAT 52

REVISIONS


20'-0"
40'-6
ELEVATION
CATSKILL POWER DIST.
REVISIONS
SWINGING BRIDGE
OVER
POWER LINE CONFLICT